Chapter II: Alternatives (Including the Preferred Alternative)

Introduction

This chapter describes the three action alternatives selected for analysis for the *Final Yosemite Fire Management Plan/Environmental Impact Statemen*t (EIS). It also describes the No Action Alternative that represents the existing fire management program. Each of the three action alternatives presents a separate comprehensive proposal for the restoration of fire to park ecosystems and the management of hazardous levels of vegetative fuels. Each alternative proposes to use prescribed and managed wildland fire, as well as mechanical methods to reduce forest fuels in developed areas. Alternatives differ in the time and methods used to accomplish restoration and fuel reduction. A detailed description of the effects on the environment of each alternative follows in Chapter 4, Environmental Consequences.

The No Action Alternative, as required by the National Environmental Policy Act (NEPA), would continue the current fire management program. This program includes hand cutting and pile burning of trees generally less than 12"dbh, prescribed fire, managed wildland fire, and suppression strategies. It has been in effect since roughly 1970, but has not been meeting the park's land management objectives at the rate needed for comprehensive ecosystem maintenance and restoration. In addition, the current program does not satisfy the new requirements of the National Fire Plan and the 2001 Federal Fire Policy, such as emphasizing the importance of protection of wildland urban interface (WUI) communities from unwanted wildland fire.

The action alternatives (Alternatives B, C, and D) propose new operational methods and objectives for ecosystem maintenance, ecosystem restoration, and hazardous fuel reduction for the Yosemite fire management program. These methods also would meet the long-term goals of Yosemite's *General Management Plan*, *Resources Management Plan*, and *Vegetation Management Plan*, as well as fulfill the requirements of the National Fire Plan and Federal Fire Policy.

Process for Formulating the Alternatives

The *Yosemite Fire Management Plan* was last revised in February 1990. Yosemite National Park has long recognized that fire management should evolve as results from research and monitoring reveal new information about fire ecology, fire behavior, and fuels management. This process is known as adaptive management. Scientific knowledge and experience have been critical in developing methods to manage fire in the park. In addition, participation from the public and federal, state, and local agencies is an important component in planning processes in Yosemite.

The action alternatives considered in the *Final Yosemite Fire Management Plan/EIS* were developed from comments and concerns expressed by the public; federal, state, and local agencies; guidance from existing park plans; policy guidance from the National Park Service, the National Fire Plan, and Federal Fire Policy; and research, monitoring, and experience from the existing fire management program and the U.S. Geological Survey Biological Research Division, Yosemite Field Station.

The 2001 Federal Fire Policy emphasizes the use of prescribed and wildland fire to meet land management goals, restore ecosystems, and assure public and firefighter safety. The National Fire Plan calls for increases in fuel reduction to protect WUI areas (communities, developed areas, structures, and utilities) from fire. These guiding principles provided direction as the alternatives in the *Draft Yosemite Fire Management Plan/EIS* were developed.

Members of the public; federal, state, and local agencies; and the National Park Service identified important issues during two periods of public scoping. Preliminary scoping took place in early 1999. In March and April of 2001, an additional scoping period was announced with the Notice of Intent to prepare an EIS on the *Yosemite Fire Management Plan*. Scoping comments focused on air and water quality, mechanical fuel reduction, Wilderness, sensitive species, and other matters. The issues identified during public scoping are summarized as concern statements in Chapter 1.

The Yosemite fire management staff used the issues first identified in 1999 to begin consultations with fire and resource management specialists in Yosemite National Park and in other fire and land management agencies to develop goals and objectives and to evaluate potential fire management activities. Concepts for developing a range of alternatives began taking shape in December of 2000, following consultations with the park's Resources Management Division. It was suggested that the alternatives vary in two ways:

- By various combinations of wildland fire, prescribed burning, fuels treatments, and fire suppression considered in the program, and
- By the amount of time needed to reduce fuels in developed areas and restore or maintain the natural fire regime throughout most of the park.

Finally, the comments received during the March and April 2001 scoping period were used to further develop the range of alternatives and identify needed analyses.

The appropriate type, amount, location, and boundaries of proposed fire management activities were based on the identification of existing conditions, departures from the natural fire return interval, and target conditions (see Ecological Basis for the Alternatives, below). In addition, because program development based on sound science and practical experience is vital to Yosemite's fire management program, adaptive management became a component of each alternative.

Proposed fuel reduction and fire activities were evaluated as to whether they were reasonable and/or feasible. Some actions were considered and dismissed from detailed study. The Council on Environmental Quality regulations state that only a reasonable number of examples covering the full spectrum of alternatives must be analyzed and compared [40 CFR Parts 1500-1508 (1987)].

National Park Service staff used project goals and objectives, policies and planning guidance, and public concerns to combine individual actions, and thus fully develop the three action alternative concepts that were carried forward for detailed analysis. Once the alternative concepts had been developed, they were more fully evaluated within the framework of meeting or, as appropriate, balancing the criteria outlined below.

Evaluation of the alternative concepts also determined if they would need to be modified to meet the broad goals of the *General Management Plan, Resources Management Plan, Vegetation Management Plan*, and *Merced Wild and Scenic River Comprehensive Management Plan*. Alternatives were assessed for how well they adhered to laws and regulations pertaining to special land designations, in particular the Wilderness Act, the Wild and Scenic Rivers Act, and the California Wilderness Act of 1984 which established Yosemite's designated Wilderness and the Tuolumne Wild and Scenic River.

The environmental consequences of implementation were identified by the planning team and other park staff members. Following an internal administrative review, the proposed alternatives were modified and refined, and suggestions were made to modify the analysis of environmental consequences to better address effects on park resources and other fire management issues including WUI protection.

The Preferred Alternative was chosen after evaluating each alternative based on: (1) how well it achieved the purpose of and need for the *Yosemite Fire Management Plan*; (2) how well it achieved the goals of the *General Management Plan, Resources Management Plan*, and *Yosemite Vegetation Management Plan*; and (3) how well it addressed issues and concerns expressed by the public. The planning team recommended Alternative D as the preferred alternative in the *Draft Yosemite Fire Management Plan /EIS*, and this remains so in the final EIS.

Reviewing and Modifying the Draft Plan

The *Draft Yosemite Fire Management Plan/EIS* was mailed to the public on May 10, 2002. The document also was available for public review on the park's website. Written comments were accepted through August 27, 2002. Each of the public comment letters and other communications (including emails, faxes, and public hearing transcripts) was read and analyzed. The planning team examined public comments in the context of improving the proposed alternatives to better achieve goals and to meet the project's Purpose and Need.

Each member of the planning team was given responsibility for evaluating public comments and developing responses to them. These comments and responses are shown in Appendix 12. Each substantive issue was evaluated in terms of its:

- Magnitude
- Linkage(s) to other issues
- Basis for modification of proposed alternatives, including technical and fiscal feasibility, compliance, planning, and implementation
- Compliance with guidance and direction provided by National Park Service and Federal Fire Management Policy
- Ability to achieve planning goals for resource protection and visitor experience

The team recommended changes to the draft alternatives, including the Preferred Alternative, and the *Final EIS* was prepared. A Record of Decision (ROD) will be completed following release of the *Final Yosemite Fire Management Plan/EIS* to the public, and the completion of a 30-day waiting period.

After the ROD is approved, a separate document, the *Yosemite Fire Management Plan,* will be prepared and made available upon request. This plan will present a detailed description of the fire management program selected for implementation, and discuss any recommendations and actions that were recorded as part of the ROD.

Criteria

National Park Service staff used the project goals and objectives described in Chapter 1, policies and planning guidance, and public concerns to fully develop the three action alternative concepts that were carried into detailed analysis. In addition, the alternative concepts were examined again to verify that they satisfied a set of criteria based on the many acts, laws, and regulations under which Yosemite National Park operates.

For the Yosemite Fire Management Plan the criteria are:

- **Restore or maintain natural fire regimes.**
  - Actions should move toward restoration of the natural fire regime in areas of the park where natural or prescribed fire is an acceptable method of vegetation management.
  - Actions should move toward restoration and maintenance of the natural range of variability for plant community structure and fuel load

- **Focus on ecosystem processes.**
  - Actions should allow natural processes to prevail where they do not threaten structures or protected areas.
  - Actions should further ecosystem restoration so fire processes may be used to help sustain or maintain park ecosystems.
- **Protect and maintain cultural landscapes and historic and prehistoric resources.**
  - Actions should help maintain and protect cultural landscapes and landscape features.
  - Actions should maintain relatively light surface fuel loading on, and adjacent to, archaeological sites and historic structures.
  - Actions should protect cultural resources, to the extent feasible, from the damaging effects of fire and fire management actions.
  - Actions should sustain traditional cultural and natural resources where traditional activities such as plant gathering are important.
- **Manage consistently with other land use designations within Yosemite National Park.**
  - Actions should support Wilderness characteristics.
  - Actions should protect and enhance Outstandingly Remarkable Values (ORVs) within the boundaries of Wild and Scenic Rivers and protect ORVs outside the boundaries. In the case of the Tuolumne Wild and Scenic River, values for which the river was designated should not be degraded.
- **Establish and manage Special Management Areas to accomplish area specific goals**.

- Actions should protect and provide for the special management needs found in:
    - Giant sequoia groves
    - wildland/urban interface areas
    - boundary areas
- Actions should reduce the risk of high-intensity wildland fire and restore more natural plant community structure and fuels loads in areas adjacent to Special Management Areas.

Ecological Basis for the Alternatives

Information on fire history and fire ecology was used to assess the current ecological condition of plant communities in the park and to develop a set of target conditions for vegetation and fuels. Target conditions were developed in conjunction with fire specialists at Sequoia and Kings Canyon National Parks (Table 2.3). Existing and target conditions were used to determine the appropriate type, amount, and location of fire management activities and the boundaries of fire management units in the action alternatives in this plan.

Fire Return Interval Departure (FRID)

Process

The relative magnitude of difference between existing and target conditions in various plant communities around the park can be displayed using the fire return interval departure (FRID). A *fire return interval* is derived from fire history research and is the number of years between fires at a specific location or plant community. For example, a fire scar analysis of a sample of ponderosa pine trees might show that fire occurred in that stand before the arrival of pioneers from as frequently as every two years (*minimum value*) to as infrequently as every six years (*maximum value*). The *median value* for the stand would be approximately four years.

The fire return interval for a given vegetation type can be used in conjunction with modern fire history maps to determine where naturally occurring fires have been absent for an unusually long period, generally because of fire suppression activities. This information is known as the *fire return interval departure* (FRID).

Maximum fire return interval departure ($FRID_{max}$) represents the most conservative estimate of how severe the deviation from natural conditions might be in terms of fuels and vegetation. *Median fire return interval departure* ($FRID_{med}$) gives a more moderate view, while the *minimum fire return interval departure* ($FRID_{min}$) presents the most extreme indication of how far the stand is from its natural condition. The *Final Yosemite Fire Management Plan/EIS* presents a range of fuel reduction target acreages based on the median and maximum fire return interval departures.

For example, if fires were suppressed in the above-mentioned stand of ponderosa pine trees for 60 years, the stand would have missed 30 fires based on the minimum fire return interval of 2 years, 15 fires based on the median interval of 4 years, and 10 fires based on the maximum interval of 6 years.

A geographic information system (GIS) based analysis was used to display FRID on a landscape scale. This analysis, originally developed in Sequoia and Kings Canyon National Parks (Caprio and et al. 1997), uses deviations from the natural fire return interval as an indicator of change in natural

conditions (van Wagtendonk et al. 2002). Larger deviations are interpreted to be areas at greater risk of unnaturally intense and extensive wildland fires.

The first step in the FRID analysis was to group vegetation types into fire vegetation types that are based on similar fuels and fire behavior (see Appendix 10 and Map 2-1). The second step was to assign median and maximum fire return intervals to fire vegetation types (see Map 2-2). The third step was to use fire scar, fire history, and stand structure studies conducted in the Sierra Nevada to create a map of when each acre of the park had last burned (see Map 2-3).

Fire history maps date back to 1930 for the park in general and to 1958 for the El Portal Administrative Site. The period when fire suppression became a significant ecological factor, or "effective," varies throughout the park, and is the subject of debate. Fires were suppressed in Yosemite Valley as early as the 1860s. The removal of American Indians and their traditional use of fire in the area certainly affected the fire history of the park, as did fires set deliberately by sheepherders or accidentally by miners.

It is also likely that Cavalry patrols, especially between 1890 and 1916, found and suppressed many fires. More organized suppression programs occurred with Civilian Conservation Crews in the 1930s, and have continued to the present time with increasingly sophisticated methods of fire suppression. However, small fires burning in more natural fuel conditions decades ago that were suppressed using simple methods could, if left alone, have eventually grown to large, ecologically significant fires. Scientists at Yosemite and at Sequoia and Kings Canyon National Parks agree that fire suppression probably became significant between approximately 1870 and 1910 (Stephenson 2003).

The final steps were to calculate departures from the natural fire return interval and to create maps depicting the number of interval departures for both the median (Map 2-4) and maximum (Map 2-5) fire return interval departures (FRIDs). The algebraic formula used was:

$$\text{FRID} = \frac{|\text{Fire Return Interval} - (\text{Current Year} - \text{Year Last Burned})|}{\text{Fire Return Interval}}$$

For example, if the fire return interval is considered to be 20 years, the current year is 2004 and the area last burned in 1904, the FRID is the absolute value of (20-100)/20 = 4.

The FRID process resets the FRID value back to zero after an area is burned. It is recognized that resetting the FRID back to zero after an area has burned may not be correct, since the fire may have burned in a very patchy manner, leaving some areas lightly or even unburned. Additional sampling of burned areas, such as the Ackerson Fire, will be needed to determine if the conditions created by the fire are similar to those which existed under a more natural fire cycle.

Results

Results of the median FRID analysis indicate that 62% of park vegetation is considered to be in acceptable ecological condition (i.e., low deviation from natural fire regime; Table 2.1; FRID is 0 or 1). These areas are expected to remain in acceptable ecological condition as long as the natural fire regime is maintained. Thirteen percent of park vegetation shows moderate deviation from natural conditions (FRID is 2 or 3), and 25% of park vegetation is considered highly compromised by past

fire suppression (FRID is 4 or more). In the El Portal Administrative Site, 38% of the area is considered to be in an acceptable condition, 43% shows moderate deviation from natural conditions, and 19% shows a high departure (Table 2.2).

Much of the area with a moderate or high deviation from natural conditions is in the western portion of the park, in lower elevation forests where fires have been suppressed either because of the presence of nearby communities or of park boundaries. Of the approximately 47,000 acres that burned due to the 1996 Ackerson Fire near Hetch Hetchy and Aspen Valley, almost 36,000 acres had a FRID of 5 or more.

The analysis shows positive effects from fire management activities, as many areas are in acceptable condition, but also underscores the fact that large areas require attention. Therefore, while the current fire management program has been successful in some areas of the park, a significant portion of the park is continuing to trend toward significantly unnatural ecological conditions.

This deviation is particularly serious because it occurs in areas of high public presence and is near communities. In all alternatives, wildland fires would continue to be suppressed in these areas due to safety constraints. The areas would be managed to restore ecosystems while reducing risk of unwanted fire through prescribed fire and mechanical fuel reduction in the WUI, along road and utility corridors, and in other areas with resources needing protection.

Table II-1
Fire Return Interval Departures by Percentage of Vegetation Type for Median Fire Return Intervals in Yosemite National Park

Vegetation Type in Yosemite National Park	Percentage of Vegetation Type		
	Low 0-1 $FRID_{med}$	Moderate 2-3 $FRID_{med}$	High ≥4$FRID_{med}$
Whitebark pine and/or mountain hemlock forest	100	0	0
Lodgepole pine forest	100	0	0
Red fir forest	100	0	0
Western white pine/Jeffrey pine forest	31	2	67
Montane chaparral	100	0	0
Giant sequoia/mixed conifer forest	83	0	17
White fir/mixed conifer forest	51	1	48
Ponderosa pine/mixed conifer forest	54	3	43
Ponderosa pine/bear clover forest	53	5	42
California black oak woodland	29	7	64
Canyon live oak forest	50	2	48
Dry montane meadow	16	7	77
Foothill pine/live oak/chaparral woodland	89	0	11
Foothill chaparral	100	0	0
All Vegetation Types in Yosemite National Park	**62**	**13**	**25**

Table II-2
Fire Return Interval Departures by Percentage of Vegetation Type for Median Fire Return Intervals at the El Portal Administrative Site

Vegetation Types in El Portal Administrative Site	Percentage of Vegetation Type		
	Low 0-1FRID$_{med}$	Moderate 2-3 FRID$_{med}$	High ≥4FRID$_{med}$
Ponderosa pine//mixed conifer forest	8	92	0
Canyon live oak forest	0	100	0
Foothill pine/live oak/chaparral woodland	31	1	68
Foothill chaparral	100	0	0
Blue oak woodland	71	5	24
All Vegetation Types in El Portal Administrative Site	38	43	19

Target Conditions for Vegetation and Fuels

Target conditions for vegetation and fuels in Yosemite have been established using information from a number of sources including scientific studies, monitoring data, and professional evaluations (Table 2.3). Target conditions describe vegetation in two ways: as a set of structural features for the vegetation types, and as a set of fire-related ecosystem processes that help sustain the vegetation types. Target conditions are a range of monitoring variables that measure the effectiveness of program implementation.

In general, target conditions for restoration are based on plant community structure, while target conditions for maintenance are based on ecosystem processes. The general objectives for vegetation in fire management terms are to:

- *Restore* fire and a more natural ecosystem structure to plant communities that have missed more than three fire return intervals.
- *Maintain* plant communities that have missed less than four fire return intervals and are within, or close to, their natural range of variability.

Restoration Targets

Vegetation *restoration* is needed when an ecosystem has missed so many naturally occurring wildland fires that the types and ages of plants are not what would be expected in that vegetation type if fires had been allowed to burn. Restoration actions aim to establish a vegetation structure that will allow natural ecosystem processes, including fire, to maintain them over time. The structural targets developed for major vegetation types of the Sierra Nevada (Table 2.3) are used to determine if an ecosystem is within its natural range of variability. Targets are not based on ecosystem conditions that existed on any specific date in history, but on a general range of conditions that existed prior to the onset of fire suppression in the latter part of the 19th century, when the area was settled by pioneers and by the military.

Most areas slated for restoration are on the western side of the park. Reducing the fuel load either by prescribed burns, or by removing live and dead vegetation mechanically and then burning the area, would decrease the risk of unnaturally intense stand replacement fires and would help restore vegetation structure in plant communities to more natural conditions. Restoration target conditions were developed for each vegetation type using variables that measure plant community

structure. These include gap distribution, density, frequency by species composition, and fuel load (Table 2.3). These variables are discussed below.

Gap distribution describes the occurrence of open spaces in the forest canopy. Three gap sizes were used: small (0.1-1 hectare); medium (1-10 hectare); and large (10-100 hectare). For example, restoration targets for ponderosa pine/mixed conifer forest would result in many small gaps, indicative of a forest with a relative fine-grain mosaic of age classes and predominantly low intensity surface fires. Among all gaps in this community, 75-95% should be small, 5-25% should be medium, and less than 1% should be large (Table 2-3).

Density is the number of trees per acre. For fire management analyses, trees are separated into two size classes, based on age to diameter relationships and the length of time fires have been suppressed. Very generally, trees greater than 31.5" diameter at breast height (dbh) tend to have been established prior to the onset of fire suppression in the latter half of the 19th century, but this can vary widely by site and local growing conditions.

Establishment of new trees, especially shade tolerant trees such as white fir and incense-cedar, increased when wildland fires were suppressed. Over the decades, these trees have grown without the influence of fire as a natural thinning agent. Thus, it can generally be said that the existing density of trees less than 31.5" dbh, and especially less than 20" dbh, is higher than during periods in which fires burned freely, which is estimated to be before 90 to 130 years ago (Stephenson 2003)

The 31.5" dbh breakpoint should be applied with caution, because the study trees that suggested this diameter were from a specific location and elevation - Giant Forest in Sequoia National Park, at approximately 6500' elevation. Data from the Sequoia study do not present a complete picture of what Yosemite's forests looked like before fire suppression.

Because of the caution required when applying limited research findings, actual tree thinning by mechanical means to meet forest restoration objectives will only occur on trees up to 20" dbh in the inner WUI under this EIS. This size is consistent with the *Sierra Nevada Forest Plan Amendment Final EIS Record of Decision* (USDA 2001). This limitation is also in response to many comments received from the public during the review of the *Draft Yosemite Fire Management Plan/EIS* (Appendix 12).

In Yosemite, the actual age distribution of trees would be measured in each stand before developing thinning prescriptions and undertaking activities to restore the stand to forest target conditions through mechanical methods. This would occur both under this EIS for forest restoration thinning in the inner WUI as well as for any future environmental compliance documents developed for forest restoration thinning projects in the outer WUI area.

Frequency by species composition is the composition of trees that comprise a given vegetation type, and is derived by counting the number of trees by species greater than 31.5" dbh in fire effects study plots. If plots were not available in Yosemite for a particular vegetation type, data from fire effects plots in similar vegetation types in Sequoia and Kings Canyon National Parks were used.

Fuel load is a measurement of dead and down wood, litter, and duff expressed in tons per acre. Dead and down fuels were evaluated across the landscape and put into categories: light fuel load is 5-30 tons per acre, moderate fuel load is 30-60 tons per acre, and heavy fuel load is greater than 60 tons per acre. Target conditions for fuel load in ponderosa pine/mixed conifer forest would be

light across 20-40% of the landscape, moderate across 20-50% of the landscape, and heavy across 5-20% of the area.

Table II-3
Restoration Target Conditions

Preliminary target conditions by vegetation type for restoring plant communities by reintroducing the natural fire regime in Yosemite National Park. Restoration target conditions are based on structural features of vegetation types. Variables are number and size of forest openings or gaps, tree size, species composition, and amount of live and dead vegetative fuels.

Vegetation Type	Gap Distribution (gap size and % landscape) 1 ha = 2.47 acres	Density and Frequency by Species Composition (density: on stand level frequency: % of landscape)	Fuel Load (% of landscape)
	Gaps smaller than 0.1 ha are difficult to detect. Gaps are based on consensus expert opinion from Sequoia and Kings Canyon National Parks and work from Lassen Volcanic National Park by Dr. Alan Taylor and will be refined for Yosemite as research and monitoring is accomplished. Numbers are relative percentage of gap size compared to all gaps.	*DBH indicates diameter at breast height in inches. General guidelines are based on age/diameter relationships established for some species. Greater than 31.5 inches is assumed to be pre-settlement (generally established prior to latter half of 19th century). The smallest tree within the size range is considered to be 4.5 feet tall (i.e., breast height)*	*A complete lack of fuel in a measurable area occurs infrequently due to the patchiness of fire. Fuel bed depth, height to the base of live crown (canopy), and crown bulk density are not currently program goals; these inputs are needed to model crown fire potential or risk.*
Red Fir Forest	0.1-1 ha = 70-95% 1-10 ha = 5-30% 10-100 ha < (less than) 1% and 0-1% of the gaps < (are less than) 1 year old	20-202 trees/acre < (is less than) 31.5 inches[1] 4-30 trees/acre > (is greater than) 31.5 in[2a] and Composition is 70-100% fir + 0-30% pine[2a]	1-25% = (of the area has) 5-30 tons/ac 30-70% = 30-60 tons/ac 5-20% > (of the areas is greater than) 60 tons/ac
Montane Chaparral	Not Applicable – woodland/savannah type	4-61 trees/acre < 31.5 in[1] 2-20 trees/acre > 31.5 in[2a] Composition is 60-80% pine + 20-40% fir[2a]	1-30% = 5-30 tons/ac 25-75 = 30-60 tons/ac 5-20% > 60 tons/ac
Giant Sequoia/ Mixed Conifer Forest	0.1-1 ha = 75-95% 1-10 ha = 5-25% 10-100 ha < 1%	20-101 trees/acre < 31.5 in[1] 4-26 trees/acre > 31.5 in[2] Composition is 35-65% fir, 0-20% sequoia, 40-55% pine[2]	20-40% = 5-30 tons/ac 20-50% = 30-60 tons/ac 5-20% > 60 tons/ac
White Fir/Mixed Conifer Forest	0.1-1 ha are 75-95% 1-10 ha are 5-25% 10-100 ha < 1%	20-89 trees/acre < 31.5 in[1] 4-20 trees/acre > 31.5 in[2] Composition is 40-65% fir, 15-50% pine, 0-10% cedar[2]	20-40% = 5-30 tons/ac 20-50% = 30-60 tons/ac 5-20% > 60 tons/ac
Ponderosa Pine/ Mixed Conifer Forest	0.1-1 ha are 75-95% 1-10 ha are 5-25% 10-100 ha < 1%	4-91 trees/acre < 31.5 in[1] 4-30 trees/acre > 31.5 in[2] Composition is 60-95% pine, 15-40% cedar, 1-10% oak[2]	20-40% = 5-30 tons/ac 20-50% = 30-60 tons/ac 5-20% > 60 tons/ac
Ponderosa Pine/Bear Clover Forest California Black Oak Canyon Live Oak Forest	Will be determined through research and monitoring, i.e., through the adaptive management process. Application strategies would be revised and refined, using the results of monitoring and new research, to improve methods for achieving target conditions and expand monitoring objectives.		

Vegetation Type	Gap Distribution (gap size and % landscape) 1 ha = 2.47 acres	Density and Frequency by Species Composition (density: on stand level frequency: % of landscape)	Fuel Load (% of landscape)
Low Meadows/Dry Montane Meadows		Lessons learned are documented in post-burn evaluation and factored into future prescribed burn plans.	
Foothill Pine/Live Oak/Chaparral Woodland			
Blue Oak Woodland			

[1] Based on consensus expert opinion for Sequoia and Kings Canyon National Parks; the smallest tree in the range would be 4.5 feet tall (i.e., breast height).

[2] Based on fire effects monitoring data for 'pre-settlement' tree from Yosemite; additional databases may be available to refine targets.

[2a] Sequoia and Kings Canyon National Parks fire effects monitoring data.

Table II-4
Maintenance Target Conditions

Preliminary target conditions by vegetation type, for maintaining the natural fire regime within plant communities in Yosemite National Park. Maintenance of ecosystems is based on ecosystem process variables of fire return interval, seasonality of fire occurrence, and severity.

Vegetation Type	**Fire Return Interval Range[1]**	**Season[1] (% of area burned)**	**Fire Size[2]** ***Largest natural fire recorded in type since 1930 through 2000.***	**Fire Severity[3]**	**Fire Intensity[4] [British Thermal Unit (BTU)/ft/sec]**
Assumptions:	*Distribution (and variation) is important.*	*Fires can start anywhere (including outside of vegetation type).*	*Indicative of natural fire behavior in higher elevations, and effects of fire suppression in lower elevations.*	*Severity = mortality of dominant vegetation*	*Percent of landscape*
Whitebark Pine and/or Mountain Hemlock Forest	4-508 years Median = 187 *l*	0-5% Jan-Jul 90-100% Aug-Oct 0-5% Nov-Dec	20 acres	Low 60-90% (surface) Mod 5-20% High 5-20% (single tree)	1-40 (mean = 10)
Lodgepole Pine Forest	4-163 years Median = 102 *j*	0-10% Jan-Jul 80-90% Aug-Oct 0-10% Nov-Dec	773 acres	Low 15-30% (surface) Mod 35-50% (surface) High 15-35% (crown?)	1-40 (mean = 10)
Red Fir Forest	9-92 years Median = 30 *l*	0-10% Jan-Jul 80-90% Aug-Oct 0-10% Nov-Dec	1,265 acres	Low 30-60% Mod 20-40% High 0-15%	1-120 (mean = 25)
Western White Pine/Jeffrey Pine	4-96 years Median = 12 *c*	Yet to be determined	3274 acres	Yet to be determined	20-1000 (mean = 100)
Montane Chaparral	10-75 years Median = 30 *k*	0-20% Jan-Jul 50-70% Aug-Sep 10-30% Oct-Dec	641 acres	Low 30-90% Mod 10-60% High 0-25%	1-60 (mean = 30)
Giant Sequoia/Mixed Conifer Forest	3-15 years Median =10 *g*	0-20% Jan-late Aug 40-60% late Aug-Oct 30-50% Oct-Dec	Less than 1 acre	Lower slopes: 60-100% L, 5-35% M, 5-10% H Upper slopes: 0-35% L, 20-35% M, 30-90% H	20-1000 (mean = 100)
White Fir/Mixed Conifer Forest	3-35 years Median = 8 *f*	0-20% Jan-late Aug 40-60% late Aug-Oct 30-50% Oct-Dec	1,092 acres	same as above	Same as above
Ponderosa Pine/ Mixed Conifer Forest	3-14 years Median = 9 *e*	0-30% Jan-late Aug 50-70% late Aug-Oct 30-50% Oct-Dec	960 acres	Same as above	same as above
Ponderosa Pine/ Bear Clover Forest	2-6 years Median = 4 *d*	Yet to be determined through the adaptive management process.	1,247 acres	Yet to be determined through the adaptive management process.	Yet to be determined through

Vegetation Type	Fire Return Interval Range[1]	Season[1] (% of area burned)	Fire Size[2] *Largest natural fire recorded in type since 1930 through 2000.*	Fire Severity[3]	Fire Intensity[4] [British Thermal Unit (BTU)/ft/sec]
California Black Oak	2-18 years Median = 8 *a*		37 acres		the adaptive management process.
Canyon Live Oak Forest	7-39 years Median =13 *c*		3,517 acres		
Low Meadows-Dry Montane Meadows	1-5 years Median-2 *h*		35 acres		
Foothill Pine/Live Oak/Chaparral Woodland	2-49 years Median = 8 *b*		41 acres		
Foothill Chaparral	30-60 years Median = 30 *k*	0-30% Jan – Jul 50-70% Aug – Sep 30-50% Oct – Dec	43 acres	0-1% low 1-10% moderate 90-100% high	50-6330 (mean = 3,000)
Blue Oak Woodland	2-49 years Median = 8 *b*	Yet to be determined	311 acres	Yet to be determined	Yet to be determined

1. Based on several sources: a Stephens 1997; b MacClaran and Bartolome 1989; c Taylor and Skinner 1998; d Caprio and Swetman 1993; e Kilgore and Taylor 1979; f Skinner and Chang 1996; g Swetnam et al 1991; h Anderson 1993; i Caprio et al 1997; j Keifer 1991; k U.C. Davis 1996; and, l Bahro 1993.
2. Based on GIS analysis. Included only as information on relative fire size by community type since 1930.
3. Based on unpublished A. Taylor's work at Lassen Volcanic National Park and need to be refined for Yosemite.
4. Based on BEHAVE outputs

Maintenance Targets

Maintenance targets are characterized by process variables that include fire return interval range, season of burn, fire size, fire severity, and fire intensity (Table 2.4).

Maintenance would be appropriate after restoration techniques have returned forest characteristics to within a natural range of variability (Table 2.3), and in areas that have not been significantly affected by fire suppression. In Yosemite, areas that have missed fewer than four fire return intervals are considered to be within their natural range of variability and would be managed using maintenance targets. Areas where natural process can be allowed to occur are typically found in vegetation types with long fire return intervals, in areas that have been regularly burned, and where there are no threats to buildings or other valued resources. Targets have not yet been developed for all vegetation types; additional targets will be developed and applied as information from research and monitoring becomes available.

Fire return interval range is the span of years between the shortest and longest periods between fires in a vegetation type as determined through tree ring or fire history analysis. Return intervals used are from forests in Yosemite or, if not available, the next closest location in the Sierra Nevada. Variability within the return interval is extremely important ecologically because atypical plant communities can populate an area when fire is less frequent or when stand replacement (e.g., forest replaced by chaparral) occurs following unnaturally intense fires.

Season of burn reflects the percentage of a vegetation type that has tended to burn on average for each season. For example, data on the season of burn for ponderosa pine/mixed conifer forest indicates that if an average of 10,000 acres of this vegetation type burned per year, then 20% (2,000 acres) would burn in June through early August, 50% (5,000 acres) would burn in late August through September, and 30% (3,000 acres) would burn in October through December.

Fire Size is not a target, but is indicative of the magnitude of fire size that can be expected in higher elevation communities, where natural fires have been allowed to burn. The effects of suppression can be seen in the small sizes of fires in lower elevations, such as in giant Sequoia groves. The three large wildland fires that burned in the park (A-Rock and Steamboat in 1990, and Ackerson in 1996) were excluded from this list because they are believed to have been outside of the natural range of variability for fire.

Fire severity is a measure of fuel consumption and effect on vegetation caused by fires of different intensity and/or season. Severity is divided into three categories: low, moderate, and high. Levels of severity of any wildland fire are distributed unevenly across the landscape. The variability and pattern of fire severity can be critical for establishing some species and for the formation of gaps.

Fire intensity is a physical measure of the flames, in British Thermal Units per foot per second (BTU/ft/sec). This information can be generated using BEHAVE, a fire behavior prediction computer model.

Adaptive Management

Adaptive management is a fusion of science and management used to improve and care for natural resources. It is also defined as "the process of continually adjusting management in response to new information, knowledge, or technologies (USFS 2001)." Adaptive management would be used to

guide fire management activities, while drawing on the best available science, emergent technologies, and an ever-increasing database on the role and effects of fire on park resources.

The adaptive management cycle includes development of a plan with stated goals and objectives, implementation of planned actions, monitoring of results, evaluations of the outcome of the actions, and hypothesis testing to refine prescriptions and methods (Kaufmann et al. 1994). In the fire management program, evaluations will help refine fire management strategies and assess how well the program has met goals and objectives leading to ecosystem restoration and maintenance, including fuel reduction. After each event, evaluation by fire experts and managers will determine if the action had the desired effects, if more information is needed, and if a change in actions is necessary to meet objectives. Target conditions, as outlined above, provide measurable variables through which to achieve more generally stated objectives.

Determination of Projected Annual Work

The action alternatives (Alternatives B, C, and D) were developed with three specific goals: 1) to re-introduce fire into areas of Yosemite that show adverse effects of fire suppression; 2) to maintain the natural fire regime in park ecosystems where vegetation is within its natural range of variability; and 3) to restore more natural levels of forest and fuel characteristics near communities, roads, campgrounds, and park resource values (e.g., historic sites, cultural landscapes, cabins).

The total of acres burned and mechanical fuel reduction work completed each year would include:

- Areas (acres) of fuel reduction in wildland/urban interface (through prescribed fire and mechanical cutting).
- Areas (acres) of ecological restoration and maintenance (through prescribed fire and managed wildland fire).
- Acres burned by wildland fire that escapes initial control efforts in areas scheduled for prescribed burning but still achieves acceptable ecological effects, and by wildland fires or prescribed fires that are suppressed due to smoke issues. (Current federal fire policy does not consider fires that are suppressed to have any beneficial effects. Although such acreage will be reported by Yosemite National Park according to federal fire policy requirements, the Yosemite fire management plan will count such acreage for internal use such as in FRID calculations).

Because of variability in fire and lightning occurrence from year to year, no precise estimate can be made about the number of acres that will burn annually by managed wildland fire and unwanted wildland fire. Similarly, the actual acres of prescribed fire will vary as well; years with more active wildland fires will tend to have fewer prescribed fires. It is expected, however, that the total number of acres treated from all three sources will be relatively consistent.

Establishing Priorities for Areas to be Restored

Prioritization of areas to be restored using prescribed fire or various fuel reduction techniques would be based on several factors. Priorities for treatment are the same for all alternatives. However, the amount of work done varies by alternative based on time-specific accomplishment goals. A multi-year burn schedule details proposed work (see Appendix 6). Unplanned wildland fires may also shift priorities. The priorities would generally be:

Level 1: Special Management Areas, including:

- Wildland/urban interface areas
- Giant sequoia groves
- Park boundary areas

Level 2: Prescribed fire units adjacent to Special Management Areas, some of which would be managed using maintenance targets because, due to prior burning, they are within target conditions. Prescribed fire units close to Special Management Areas would provide an additional buffer from an approaching wildland fire because fuels would be reduced, thus lowering the risk and intensity of a wildland fire.

Level 3: Maintenance burning of prescribed fire units that have been previously treated could have a higher priority than first entry (initial) burns. Keeping previously treated areas in their restored condition would be more important than treating new areas in many cases, and in particular would avoid the repeated buildup of fuels. This is especially true of burned areas that have a FRID value approaching 4.

Level 4: Areas requiring the reintroduction of fire to mitigate the potential for high-intensity fire due to four or more missed fire return intervals. These would likely be areas that have no record of being burned since the establishment of the park in 1890

Level 5: All other areas.

Acreage Determination

The Multi-Year Prescribed Fire Schedule (Appendix 6) presents tables of proposed restoration burning, maintenance burning, and fuel reduction work in the WUI. Achievement will depend on the number of burn days in a given year and other factors described below. The objective would be to meet the proposed timetable over the long run, therefore the schedule would be reevaluated and updated as necessary. Appendix 11 describes the prescribed fire units.

Restoration acreage figures in Table 2.5 are derived using Maps 2-4 and 2-5, which show areas that have missed four or more fire return intervals (based on median and maximum fire return intervals for these vegetation types). Acreage figures then were divided by the timeframe proposed in each alternative for restoration work only. This provided a range of acres to be restored annually to meet the timeframe proposed in each alternative. This average is shown in each of the years scheduled in the Multi-Year Prescribed Fire Schedule (Appendix 6).

Table II-5
Acres to be Treated in Ecosystem Restoration Areas and Wildland/Urban Interface: Comparison of Action Alternatives (Numbers rounded to nearest whole)

	Proposed duration for fuel reduction and ecosystem restoration WUI = wildland/urban interface	Ecosystem Restoration Range of Average Annual # of Acres to be Treated		Wildland/Urban Interface (inner) Average Annual # of Acres to be Treated[2]
		Median FRID Total[1] = 160,894	Maximum FRID Total[1] =31,503	Total = 6,425
Alternative B: Aggressive Action	WUI = 5 years Ecosystem Restoration in 10 – 15 years. Mean = 12.5 years	12,872	2,520	1,285
Alternative C: Passive Action	WUI = up to 10 years Ecosystem Restoration in 25 years	6,436	1,260	766
Alternative D: Multiple Action	WUI = 6-8 years Ecosystem Restoration in 15 – 20 years. Mean = 17.5 years	9,194	1,817	1,095

1 Fire Return Interval Departure (FRID) totals are the sum total of all areas that have missed four or more fire return intervals.
2 Annual averages are not annual targets but serve to show the amount of land that would need to be treated, on an average, to meet the time frame of each alternative.

The average number of acres to be treated annually in inner WUI areas is derived by dividing the total area of the designated WUI (Maps 1-2 and 2-6 through 2-18) by the number of years proposed for doing the work. These acres are also included in the multi-year burn schedule. Maintenance acres are included in the multi-year burn schedule as well. They were determined based on the length of time when last burned. It is expected that maintenance burning would make up the larger portion of the yearly burn schedule as more areas are treated and put into a rotational plan for re-treatment.

Annual Constraints to Burning

Some years are better than others for prescribed burning and, because of short-term climatic patterns such as El Nino and La Nina, natural wildland fire activity also varies greatly between years. In drier years, managed wildland fire may play a very large role in the fire program, while prescribed fire may be used only minimally. In years of higher rainfall, wildland fires are infrequent, while prescribed fires conditions may be favorable. Thus, prescribed fire may be used extensively while wildland fire activity is low in wet years.

Under all action alternatives, the amount of mechanical fuel reduction would decline after fuels in and near WUI areas were reduced. After fuel levels were within target conditions, it should be possible to use prescribed fire to maintain fuel levels and vegetation within targeted conditions. Similarly, the number of wildland fires that would be allowed to burn could be expected to increase over time, as more and more prescribed fire units were brought within target conditions. Wildland fire would then be used as feasible to maintain ecosystem health and function, as it currently does in most parts of the Wilderness. Prescribed fire would continue to be used where natural fires cannot be allowed to burn for safety reasons.

Following safety issues, the largest constraints to burning will be smoke management and air quality regulations. Prescribed fires and wildland fires that may burn for longer than two weeks will generate

complaints to local air districts. Smoke management techniques, including the division of large burn units into smaller blocks to facilitate checking fire spread when dispersion conditions deteriorate, will continue to be incorporated into prescribed fire and wildland fire plans. Smoke emissions should decrease as target conditions are reached.

Alternatives Considered in the Final Yosemite Fire Management Plan/EIS

The range of Alternatives considered in the *Final Yosemite Fire Management Plan/EIS* include:

Alternative A: No Action (Current Program)

Alternative B: Aggressive Action

Alternative C: Passive Action

Alternative D: Multiple Action

Each action alternative (B, C, and D) proposes a full range of fire management strategies to maintain and restore ecosystems and protect people, communities, valued resources, structures, and utilities from unwanted fire. Fire management strategies include managed wildland fire (typically lightning-ignited), prescribed fire (management-ignited), fire suppression, and mechanical fuel reduction.

Each alternative aims to meet the ecological target conditions described earlier in this chapter. The alternatives differ in the time required and the methods used to accomplish restoration and fuel reduction goals. Under the current program, the park is divided into three fire management *zones*, each with a different prescription for management (Map 2-19). These are redefined as three *units* (reflecting a change in national fire terminology) in the No Action Alternative. Under the action alternatives (Alternatives B, C, and D), the park would be divided into two fire management *units* as directed in the National Fire Plan—a Fire Use Unit and a Suppression Unit (Map 2-20).

Common to All Action Alternatives

Safety

Public and firefighter safety is the number one priority for all alternatives. The Federal Fire Policy states: "Firefighter and public safety is the first priority, and all fire management plans and activities must reflect this commitment." National Park Service Wildland Fire Policy (Director's Order 18) echoes this direction: "The NPS is committed to protecting park resources and natural ecological processes, but firefighter and public safety must be the first priority in all fire management activities."

The *Yosemite Fire Management Plan*, regardless of the alternative selected, will enact the following to ensure the safety of firefighters and the public:

- Every firefighter and fire line supervisor, the fire program manager, and the park Superintendent will take positive actions to ensure compliance with safe fire management practices.
- Experience, training, physical fitness, and knowledge of safety practices will be required of all people in leadership roles in fire operations.
- All wildland fire safety standards [including the 10 Fire Orders, 18 Watchout Situations, Downhill/Indirect Line Checklist, Four Common Denominators of Fatality Fires, Lookouts-Communications-Escape Routes-Safety Zones (LCES), and Risk Management/Situational Awareness] will be required annual training for all personnel involved in wildland fire operations.
- Annual hands-on fire shelter deployment training will be mandatory.
- The safety training requirements listed in Chapter 3 of National Park Service Reference Manual 18 (RM-18; NPS 1999b) will be adopted and adhered to.
- Qualifications standards for ICS (Incident Command System) positions as listed in National Wildfire Coordinating Group 310-1 "Wildland Fire Qualification Subsystem Guide" will be adopted.
- All project plans will address safety concerns in an attached Job Hazard Analysis (JHA).
- A safety briefing will be given prior to initiating work on any project.
- All Type 3 fire incidents and all prescribed burns will have an Incident Action Plan (IAP) developed for each operational shift. Every IAP will include a safety message.
- Every project or incident will have at least one person charged with incident safety oversight; complex situations will require multiple safety officers.
- All personnel will be authorized and obligated to exercise emergency authority to stop and prevent unsafe acts.
- All employees will have the right to turn down unsafe assignments; they will also have the responsibility to identify safe alternatives to accomplish the mission.
- The use of SAFE NET ground-based safety incident reporting system will be adopted and implementation procedures will be included in the employee handbook.
- After Action Reviews (AARs) will be conducted by the project leader or incident commander after each shift of a project or incident to evaluate safety and effectiveness of work performed and identify and discuss encountered hazards.
- All wildland fire incidents that result in human entrapment, fatalities, or serious injuries, or that have the potential to result in such, will be reported and investigated as required by RM-18, Chapter 3 (NPS 1999b).
- The park Superintendent (or designee) will manage critical incidents following checklists and processes contained in the National Wildfire Coordinating Group's "Agency Administrator Guide to Critical Incident Management."
- All personnel on wildland fires will be equipped with proper personal protective equipment (PPE) as described in Chapter 3 of RM-18. All personnel will carry a fire shelter on wildland fires at all times unless in a designated safety zone.

- All personnel on projects or fire management activities will adhere to special PPE requirements specific to those operations, i.e., power saws, helicopters.
- All visitors traveling inside wildland fires in Yosemite National Park will be equipped with Nomex clothing, gloves, hardhat, and fire shelter, and will be accompanied by an operationally qualified person that can maintain communications with the incident management team and recognize potential problem fire behavior.
- All visitors traveling along the margins of wildland fires in Yosemite National Park will be equipped with a hardhat and will be accompanied by an operationally qualified person that can maintain communications with the incident management team and recognize potential problem fire behavior.
- All vehicles and drivers engaged in fire management activities will meet Government Services Administration (GSA) and agency standards, as well as state licensing requirements.
- All personnel engaged in wildland fire activities in Yosemite National Park will adhere to the health screening/medical surveillance and fitness requirements of RM-18, Chapter 3.
- All fire management personnel will be provided three hours per week of duty time to achieve and maintain physical fitness levels as prescribed in RM-18, Chapter 3. Firefighters whose full-time duties are 100% arduous duty-related (helitack, handcrew, engine crew, prescribed fire) will be provided one hour per day for fitness training when circumstances allow.
- Radios will be assigned to all fire crews and monitors when working on wildland fires. Special permission must be obtained from the incident manager for individuals to work alone on actively burning fires.
- Perimeter control will be assigned on all fire management projects and incidents to prevent non-fire personnel from entering the project/incident area without escort or proper personal protective equipment (PPE). The intent of perimeter control is to prevent injury to the public from unmitigated hazards of smoke, heat, falling debris, and machinery.
- Trails and roads providing access to mechanical fuel reduction projects, managed wildland fire fires, unwanted wildland fires, or prescribed fires will be closed if such fires and/or projects present unacceptably hazardous conditions to park visitors. Wilderness permits will not be issued for trailheads leading to hazardous areas. Roads and trails will remain closed until the hazard is abated.
- Smoke warning signs on roadways and/or traffic control will be instituted during wildland fires as conditions warrant and at the direction of the Burn Boss, Incident Commander, Safety Officer, or a visitor protection representative.
- Portions of the park or the entire park may be closed by order of the park Superintendent when there is any threat to the public or firefighter safety from wildland fire or fire management activities. When and if such an action occurs, adjacent agencies and authorities will be notified as soon as possible to help manage or evacuate the closure.
- Areas of hazardous fuels adjacent to publicly or privately owned structures or along likely evacuation routes will be kept clear of debris. This requirement will fall on the owner or the agency having jurisdiction, or the renter. The minimum requirement for creating defensible space is a 30-foot radius around any structure and 10 feet on either side of a roadway. These

specifications will provide only the minimum degree of safety for firefighters and the public and are the same as prescribed by California Public Resource Code (PL 4290 and 4291).

Fire Management Units

Fire Use Unit

The Fire Use Unit is by far the largest management unit, containing 83% (621,059 acres) of the park. In this unit, managed wildland fire (typically lightning-ignited) would be the primary tool used to meet ecological target conditions. In a small portion of the Fire Use Unit (48,912 acres), additional prescribed burning may be necessary to reduce fuel loads to a point where managed wildland fire would be safe and appropriate, especially near the boundary of the Fire Use and Suppression Units. In these areas, prescribed fire units would be designated (Map 2-21).

Suppression Unit

The remaining 17% (128,044 acres) of the park would be in the Suppression Unit. Many areas in the Suppression Unit are at high risk of large, high-intensity, stand replacement fires due to high fuel loads and vegetation characteristics that create hazardous conditions. Community and visitor protection would be paramount. All wildland fires in the Suppression Unit would be immediately suppressed using the Appropriate Management Response strategy (Appendix 3). Prescribed burning and mechanical fuel reduction techniques would be used in specific areas to reduce the risk of uncontrollable wildland fires, to restore and maintain ecosystems, and to reduce hazardous fuel loads. Lightning fires would not be allowed to burn in this unit for resource benefits, as they will in the Fire Use Unit.

Special Management Areas

Special Management Areas occur in both the Fire Use and Suppression Units. They include WUI communities and other developed areas, three giant sequoia groves (Mariposa, Tuolumne, and Merced), and the boundaries of Yosemite National Park. These areas require special management because unwanted, high-intensity wildland fire could alter these areas substantially with potentially irretrievable results. They also indicate some of the logic behind the selection and prioritization of fire management projects within Yosemite National Park.

Wildland/Urban Interface (WUI)

Fire management objectives for the WUI are to restore ecosystem structure and fuel loads to more natural conditions so the potential for intense fire is reduced, to make communities safer to defend from wildland fire, and to facilitate safer evacuations in the event of wildland fire. Site-specific prescribed fire and hazard fuel burn plans would be developed for each WUI area. Burn units covered under this EIS are listed in Appendix 11. Hazard fuel and forest restoration treatments would only occur on public lands.

There are six WUI areas in Yosemite: Hogdgon Meadow, Yosemite Valley, Wawona, El Portal, Foresta, and Yosemite West. These areas contain homes, businesses, campgrounds, historic structures, and other valued resources that require special management to reduce threats to life and property from unwanted wildland fire (Map 1-2 and 2-6 through 2-18).

The six areas within the red line plus the ¼ mile buffer on Maps 2-6 through 2-18 represent the only areas (approximately 6,425 acres) in which mechanical thinning would be used to achieve forest

restoration objectives under this EIS. The red line on the maps represents the core of the WUI community area. The core plus the ¼ mile buffer is the inner WUI area, while from ¼ mile up to 1½ mile is the outer WUI area. The inner WUI and outer WUI areas are consistent with the dimensions of the "urban wildland intermix zone" described in the Sierra Nevada Forest Plan Amendment Final Environmental Impact Statement Record of Decision (USD 2001, Appendix A).

Various distances, such as 300'-400' from a structure, have been cited as the area in which vegetation and fuel management activities can make the greatest difference in the structures wildfire survivability (Summerfelt, 2003). However, in some locations the use of prescribed fire as a restoration tool for thinning would be extremely difficult within ¼ mile of structures, particularly because of the potential for embers to cause spotfires on and near buildings. Safety is the first concern for all fire management activities, and the ¼ mile buffer provides fire crews the necessary margin of safety both for themselves and for the structures they are defending from prescribed and wildland fire.

The acreage encompassed within each of the six WUI areas is derived from a combination of factors such as vegetation type, topography, expected weather, and potential fire behavior for each WUI area. However, the areas would be no farther than the 1½ mile distance used by the State of California to define the WUI zone, and is often significantly less because of these factors.

No other areas besides the six inner WUI communities are included in this EIS for mechanical thinning to restore forest target conditions. Any additional areas proposed in the future for mechanical thinning to restore forest target conditions would require further site-specific environmental compliance.

Hand thinning for hazard fuel reduction may occur parkwide for the preparation of units for prescribed fire projects or wildland fire operations without further site-specific environmental compliance. Pre-burn thinning could include removal of dead trees and dense understory near firelines, as well as removal of trees that may burn and damage or kill the canopy of high natural resource value trees, such as Yosemite Valley black oaks.

Restoration of forest structure would typically be limited to the denser end of the range of density/frequency shown in table 2.3. Fallen trees, limbs, dense understory thickets, and other fuel conditions that could contribute to intense forest fires or excessive heat or fire spread would be removed to meet target conditions.

Inner WUI Management

The inner WUI zone that immediately surrounds structures and facilities in the six WUI areas would be managed first to reduce hazard fuels using prescribed fire or mechanical means, within five to ten years depending on the alternative. Trees thinned in this initial phase would be 12" dbh and less, and would be removed with passive or aggressive methods (Table 2.6), depending on the alternative. Prescribed fire also would be used where safe and practical.

Subsequent to hazard reduction work, mechanical and prescribed fire projects would be done to restore forest structure to within target conditions, within 10 to 25 years, depending on the alternative. Under this EIS, no trees larger than 20" dbh would be removed mechanically to meet forest restoration target conditions without additional specific environmental compliance documents prepared for pubic review.

Aggressive mechanical methods would generally be used only once per site to restore forest target conditions, to minimize impacts. Aggressive methods to reduce hazard fuels and restore forest target conditions could be done concurrently in sensitive areas to reduce the need to enter an area twice with these methods. After the use of aggressive methods, passive mechanical methods and prescribed fire would be used to maintain target conditions.

Outer WUI Management

From the edge of the ¼ mile wide inner WUI zone to the limit of the outer WUI zone, at no more than 1½ miles from the WUI community, prescribed fire would be used initially for the achievement of both restoration and fuel reduction targets.

If prescribed fire does not achieve restoration target conditions in this outer WUI zone, mechanical thinning of trees up to 20" dbh, or larger, could be done to achieve these targets, but only following preparation and public review of separate environmental compliance documents. Prescribed fire would be used subsequently to maintain target conditions.

Beyond the six WUI areas, prescribed fire, and where feasible, wildland fire, would be used for forest restoration and maintenance activities. Smaller developments, such as backcountry cabins, would be protected from wildland fire by hand thinning wildland fuels near them. Mechanical work, such as handline construction, would be done to prepare an area for a prescribed fire and to protect the area from an approaching wildland fire. It would also be used within 200' of road centerlines and under utility lines to reduce hazardous wildland fuel loads.

Until a comprehensive management plan is completed for the Tuolumne Wild and Scenic River, only treatments allowable in the 1990 *Fire Management Plan* (hand cutting trees less than 6" dbh, chipping, prescribed burning) will be used in the Tuolumne River watershed (Map 5-1). Most of the plant communities within the Tuolumne River watershed are characterized by long fire return intervals and are within the natural range of variability for plant community structure and fire. Therefore, most of this drainage is in the Fire Use Unit.

Giant Sequoia Groves

Yosemite National Park contains the Mariposa, the Merced, and the Tuolumne groves of giant Sequoias. The natural regeneration of the giant Sequoia is strongly dependent on conditions produced by recurring, moderately intense fires (Harvey et al. 1977). These fires produce optimum conditions for giant Sequoia reproduction by: 1) removing thick layers of dead and downed debris; 2) leaving behind mineral soil covered by a thin layer of ash; 3) maintaining an open canopy; and 4) heating the canopy of mature Sequoias, causing them to release large numbers of seeds.

The primary management objective for each grove would be to preserve, maintain, and propagate giant Sequoias. Other localized objectives within the groves would be to maintain selected areas for aesthetic beauty and scenic vistas, to restore cultural landscapes, and to preserve historic resources such as the Merced Grove cabin. Park vegetation specialists would review plans for actions proposed that might affect the giant Sequoia groves. Mechanical thinning of trees smaller than 12" dbh with passive means may be used, especially to reduce the potential effects of unnaturally intense fire which can scorch and injure giant Sequoias.

Boundary Areas

Boundary areas are a priority for fuels management because of the risk of unwanted wildland fires that could burn into or out of the park. For example, part of the western boundary of the park from Chiquito Pass in the south to Kibbie Pass in the northwest is particularly flammable and at high risk of wildland fire due to current high fuel loading. Other boundary areas have a low risk of unwanted wildland fire.

The fire management objectives for boundary areas are to re-establish natural fuel loads and vegetation conditions to meet target ecological conditions. Fire management projects within boundary areas would require review by all agencies that share jurisdiction. Agreements may be developed with neighboring agencies to allow fires to burn across jurisdictional boundaries, if safe and appropriate. If an agreement with a neighboring agency were not in place, the Yosemite fire management staff would keep wildland fires within park boundaries.

Re-ignition of Wildland Fire

Re-ignition could occur for any wildland fire within the Fire Use Unit that had been extinguished because of high fire danger, lack of resources, or unacceptable smoke conditions. Burning the area would be done by re-igniting the original perimeter later during the fire season or at some time within three years of the fire. Within the initial fire season, the fire would be re-lit and allowed to burn and would be managed using a Wildland Fire Implementation Plan (Appendix 3). If the re-ignition were conducted during the following three fire years a prescribed fire plan would be prepared. The intent would be to burn the area the original fire would have burned. This area would be modeled using fire behavior and spread projections.

Use of Fire as a Tool on Special Resource Management Projects

Over the years, vegetation has grown and obscured numerous scenic vistas in the park, notably in Yosemite Valley. These areas no longer provide the visual opportunities that were present when the park was set aside. Other culturally important areas no longer provide the same historic value due to fire suppression. Special-status species habitat may benefit from fire management activities. The Resources Management Division would identify culturally or biologically significant areas that would benefit from the use of fire and actions would be identified to restore and maintain these sites. Each proposed site would have an operational Hazard Fuel Plan or Prescribed Fire Plan prepared and reviewed by the appropriate resource and fire specialists.

Helibase Upgrades

Three primary helibases in Yosemite National Park and the El Portal Administrative Site are used for emergency purposes, mostly medical evacuations and seasonal fire operations. All of these helibases are in or close to developed areas of the park. The projects described below are maintenance projects aimed at making three of the sites that are already in use safer for helicopter operations. At a minimum, helipads consist of a safe, flat place to land a helicopter, and vegetation is maintained to facilitate clear flight paths. None of these helibases is located in Wilderness.

Crane Flat Helibase

Over the years, several improvements have been made to the Crane Flat Air Operations Facility. In 1996, a new office was installed at Crane Flat Lookout, which allowed the park to rehabilitate the

historic lookout that has been on this ridgetop since 1929. Since 1962, this facility has been used as the primary helibase for fire suppression and rescue operations. There are three helipads and vegetation is managed for approximately 300-500' around the perimeter of the lookout to promote safe air operations and for visibility when spotting wildland fires.

The original helipad has been taken out of service because of its proximity to the lookout and the new office, but the need for three pads continues to exist since one must be kept open for emergency landings. This pad is lighted for night-time landings. The *Final Yosemite Fire Management Plan/EIS* proposes the installation of a new helicopter pad adjacent to the existing pads. Installation of the new pad would require filling an area approximately 100' by 75' on the east side of the existing pads to the existing grade. After allowing the fill to settle, a top-coat of crushed gravel would be installed and the area would be paved. All fill dirt used would be material left over from the 1997 flood that is stockpiled within the park.

The second phase of this upgrade would consist of constructing a heli-rappel training tower in the Crane Flat Lookout parking lot. This would be used so that currency training could be done without using the helicopter, thereby limiting exposure to risk and increasing safety to personnel. The tower would be 10' wide and 20' tall and would be constructed using old bridge I-beams that were salvaged from washed out bridges in the park.

El Portal Helibase

The El Portal Helibase is located on Foresta Road between the Merced River and the El Portal Sewage Treatment Facility. This helibase is used mostly for emergency medical evacuations and meets an essential need for the El Portal community. Typically, the area is used less then 10 times a year (in non-fire years). However, in years of high fire activity it can become a vital part of air operations. The proposed improvements would provide for better public and pilot safety. Currently, lack of a safe, adequate location often results in the use of Highway 140 or the schoolyard at the El Portal Elementary School. Both of these sites have serious safety risks associated with landing helicopters due to power lines and exposure to residents and the public.

Improvements would consist of installing one gate to restrict traffic and using the existing road that was reconstructed following the 1997 flood. The existing road apron would be widened and additional asphalt would be laid to provide for the installation of two 50'x 50' helipads. An asphalt spill abatement berm along the grouted rip-rap bank on the river side of the road also would be installed.

Wawona Meadow Helibase

The facility is accessed from the Meadow Loop road adjacent to the Wawona Golf Course. Road access poses risks to Wawona traffic and people trying to access the helipad. Parking is currently along the road in a forested area. Improvements to this area would involve defining and upgrading: 1) the parking area to keep vehicles from driving into forest areas to park and turn around, and 2) access from the Wawona Road, which would involve seasonal signing to reduce traffic congestion at this turn off. No work in the meadow itself would occur under this proposal.

Strategies Used to Maintain and Restore Ecosystems

Managed Wildland Fire

Any fire that burns within wildlands and is not a prescribed fire (or a structural fire) is called a *wildland fire*. Lightning ignites most wildland fires in the park, though human-caused fires may also become wildland fires. Managed wildland fire is the primary tool for restoring and maintaining vegetation in the Fire Use Unit.

Managed wildland fire is the practice of allowing a naturally-ignited wildland fire to burn while keeping it within a specific area called a *maximum manageable area* (MMA). Safety of firefighters and the public is the primary concern in managing a wildland fire. Through pre-planning, monitoring, and holding actions, many wildland fires can be kept well away from people, buildings and infrastructure, and valued resources such as historic buildings. Adverse effects on special resources (i.e., historic buildings, special-status species) can often be mitigated through a variety of actions. Elements of managing a wildland fire include public information and education, coordination with other agencies, and fire behavior research.

Because fire is a natural process in the Sierra Nevada, allowing wildland fires to burn meets park goals to maintain a natural environment. Wildland fires have been managed in Yosemite to meet resource objectives since 1972. Allowing natural fires to burn also helps maintain cultural resources such as landscapes and archaeological features.

Managed wildland fires were originally associated with Wilderness portions of the park. The first managed wildland fires were restricted to barren areas of the Sierra Crest, which rarely burned. As knowledge about fire ecology and fire behavior increased, and as management experience increased, this area was expanded.

From 1972 through 2002, 586 wildland fires have been managed, burning a total of 81,264 acres of the park. The largest number of acres burned with managed wildland fire in one year was in 1999 (14,870 acres). The second and third largest years were 1988 (12,265 acres), and 2001 (9,410 acres). Recurring fire events in Yosemite have validated scientific theories of fire ecology that were developed several decades ago.

Wildland fires that are ignited by lightning can be allowed to burn if they occur in the Fire Use Unit and meet the criteria shown in Appendix 3. The majority of managed wildland fires are less than ¼ acre. Most of these small fires occur in red fir and lodgepole pine forests and burn only a few days. During a dry year, a larger percentage of ignitions burn until the end of the season, usually late October when the first substantial precipitation occurs.

Fires that grow large and burn for weeks or months typically experience three phases of activity. The first phase is the establishment period when, after an electrical storm has passed, the fire spreads slowly on damp fuels. This phase usually lasts from 1 - 14 days. In the second phase, area and linear rates of spread and intensity can greatly accelerate as fuels dry out. Depending on the prevailing winds, relative humidity, the fire's potential for upslope movement, and the existence of natural barriers, the fire displays alternating episodes of rapid movement and relative dormancy.

Phase two may be temporarily interrupted by precipitation from additional electrical storms. This phase may continue for several weeks until the fire is confined, either by natural barriers or rains from

a major frontal storm system (NPS 1990). During exceptionally dry years and periods of drought, it is common for these fires to burn actively into late November and December if no moisture arrives.

In phase three, after late September, shorter days and lower seasonal temperatures will cause an overall decrease of activity. The fire may continue to burn for several weeks, but does not actively advance as in phase two. In Yosemite National Park, there is a 90% chance of a fire-season ending event by October 17th.

Because a fire may burn throughout the summer and fall, the effects of a managed wildland fire on plants, animals, soils, and cultural resources can vary throughout the fire area. A large fire typically burns from late-spring or early-summer, when vegetation may or may not be completely cured, through the entire summer and into fall.

Effects mimic the phases noted above with extensive fuel reduction occurring during periods of high activity when fuels are driest, and less so as the season progresses. Depending on fuel moisture conditions, within one fire there are areas of very little fuel consumption as well as areas of total fuel consumption. Hotter areas create an arrangement of small to large openings (gaps) in the canopy, which allow light onto the forest floor to start new plants or restore plants that require more sunlight than is found in dense, overgrown forests. The variability of environmental conditions and wildland fire creates a mosaic of effects on the landscape. This mosaic is hard to replicate using small prescribed fires, and is even more difficult to replicate with mechanical methods.

Prescribed Fire

Prescribed fires are management-ignited fires that are intentionally lit to meet resource objectives when predetermined and approved conditions are met. Prescribed fire has been used in Yosemite National Park since 1970 to meet a variety of resource objectives. Meadows have been burned to remove thatch (mat of dead grasses and sedges), and giant Sequoia groves have been burned to reduce undergrowth and promote Sequoia germination and new tree growth. Prescribed fire has been used to replicate traditional burning by American Indians and to improve the quality of plant material in traditional gathering areas. It has also been used widely to reduce fuels around developed areas and to restore lower elevation forests in areas where wildland fires have been suppressed for many years.

Prescribed fire can be applied in strategic locations using special techniques. By igniting fires that burn hot enough to create openings in a forest canopy, gaps can be created that would provide protection from unwanted wildland fire. These openings, typical of a naturally fire-influenced forest, can break up vegetation continuity that supports crown fires near areas where protection of life and property is critical. Prescribed burns used in this manner provide a fuel-transition area that will help prevent rapid, uncontrollable fire spread for a decade or more. These treated areas can also provide locations where tactical plans can be implemented to stop the spread of an unwanted wildland fire.

From 1970 through 2002, fire managers in Yosemite have ignited 205 prescribed fires, burning a total of 46,791 acres. In only two years, 1978 and 1997, have more than 4,000 acres been treated. This amount of burning has not been enough to undo the impacts of several decades of landscape-scale fire exclusion.

Prescribed burn units usually require multiple burns to meet resource objectives. The first prescribed burn typically kills understory vegetation and consumes ground fuels. A second burn cleans up fuel that is deposited from burned vegetation and thins the new plants that sprouted following the first

burn. Subsequent burns maintain a fire-influenced forest and reduce fuel that has built up since the last fire. In Yosemite National Park, 7 to 12 years typically pass between prescribed burns. Prescribed fire is thus used to keep specific areas within target conditions.

Pre-treatment for Fire Protection

Pre-treatment of prescribed burn units involves removing trees, shrubs, and snags prior to the burn to help keep the fire within the designated area or to protect specific resources. The use of mechanical equipment to remove trees and shrubs can increase the safety and effectiveness of a prescribed burn, especially in areas surrounding the WUI. In addition, pre-treatment significantly increases protection of cultural resources from the potentially damaging effects of prescribed burning. Removing fuels prior to burning increases the ability of firefighters to control the burn. Many communities in and near Yosemite will need considerable pre-treatment before burning can be performed in adjacent areas on a scale large enough to protect areas from unwanted wildland fire.

Hazard Fuel Reduction Options

Numerous techniques are available to reduce or remove hazardous fuels in forest systems. In general, live and dead vegetation can either be burned or mechanically removed. Prescribed fire, managed wildland fire, and mechanical removal of trees and shrubs are proposed in all action alternatives to remove or reduce fuels. Specific laws prohibit the use of some mechanical fuel reduction techniques in specific areas. For example, the use of vehicles to remove fuel in Wilderness is prohibited. No new roads will be constructed for hazard reduction or forest restoration activities.

The action alternatives propose a variety of methods to mechanically remove live and dead trees and surface fuels. These methods are classified as either aggressive or passive reduction techniques (Table 2.6). Both techniques are used to accomplish the dual objectives of removing hazardous fuels and restoring vegetation target conditions. Aggressive and passive tree and shrub removal techniques for restoration of target forest conditions would occur only on public lands in the core and inner WUI zones of the six wild-urban interface areas (Wawona, Yosemite Valley, Foresta, Yosemite West, Hogdgon Meadow, and El Portal).

Only passive methods for reducing wildland hazard fuels would be used to clear non-Wilderness roadside vegetation (shrubs and small trees less than 20" dbh) within 200' of the centerline and under utility lines. Public roads subject to this treatment would be inside five WUI communities (Yosemite Valley is excluded), the El Portal, Big Oak Flat, and Wawona Roads within the Suppression Unit; the roads to O'Shaughnessy Dam at Hetch Hetchy, Aspen Valley, and Glacier Point, and the fire motorway roads shown on Maps 2-23 and 2-24. **No new roads would be constructed for thinning operations anywhere in the park.**

Aggressive fuel removal techniques would more quickly restore target structural conditions and reduce the risk of unwanted wildland fire near the six WUI communities. Aggressive fuel reduction techniques would not be used in any Wilderness areas in Yosemite National Park, and would generally only be used once per site. Passive fuel reduction methods and prescribed fire would subsequently be used to maintain forest structure target conditions, as well as to prevent the reoccurrence of hazardous amounts of wildland fuel. Wildland fire would be allowed to burn to maintain these conditions as well, where safe and practical to do so. The overall goal is to allow natural processes to manage fuel and ecosystem conditions as fully as possible.

Table II-6 Hazardous Fuel Reduction
Techniques for Tree and Shrub Cutting and Removal (both live and dead)

Technique Used for Hazard Fuel Reduction	Description
Aggressive Reduction Techniques (Alternatives B and D only)	
Mechanized Tree and Shrub Removal (feller-bunchers and forwarding)	Tracked equipment with cutting head severs stem and mechanically lays tree down; stem is stacked whole or mechanically de-limbed and cut-to-length, then decked (stacked) for transport by self-loading rubber-tired forwarder. Used for removal of live trees.
Conventional Tree and Shrub Removal (saws, skidders, and grapplers)	Hand crews walk to each tree and fell tree and limb with a chainsaw; tracked or rubber-tired tractors grapple or winch trees or logs and drag them to landings where they are loaded onto trucks to pile for burning. Used for removal of live and dead trees and shrubs.
Machine Crushing/Shredding	Tracked equipment travels to each tree or stump (or within reach of stump—max. 30 feet for "Brontosaurus" shredder head on excavator arm); vegetation is crushed under tracks or shredded by flail cutters, and left onsite. Various equipment types can be used. Used for removal of live trees and shrubs and dead and down material.
Machine Piling	Tracked or rubber-tired tractor grapples or pushes vegetation with front blades and piles it. or tracked excavator with bucket and thumb grapples and piles vegetation. Used following tree removal techniques or for preparing dead and down material for burning or chipping.
Passive Reduction Techniques (Alternatives B, C, and D)	
Yarding (various methods)	Cables are suspended from landings and trees or logs are attached to the cables and lifted or dragged to natural openings or landing areas. May involve use of fetching arches, which would reduce surface disturbance. Used to remove freshly cut or dead and down material from burn units.
Hand Cutting/Piling	Hand crews drive or walk to fuel reduction areas and cut with a chainsaws; hand crews pile in place or carry, roll, or drag vegetation to burn sites. Cultural resource technicians clear burn pile. locations.
Cutting/Chipping	Vegetation is transported to the chipper or the chipper is towed through the treatment units or located at approved staging areas. Chips may be broadcast 1" deep, trucked to other areas for use in the park, sold, or given away for cost.
Low-Impact Skidding	Trees are cut by conventional methods and the stem is skidded using horses or ATVs. May involve use of fetching arches, which would reduce surface disturbance. This technique is size limiting in that large trees both live and dead exceed the capability of the technique. Use would limit the ability to achieve restoration in some areas where larger trees need removal.
Girdling (promote tree mortality over a period of time)	Hand crews walk to each tree and cut a four-inch ring into the xylem, or trees are wrapped with fireline explosives and "shot"; ponderosa pines may be baited with pheromone lures to produce bug-kill.
Limb Removal (trees standing after project is done)	Lower (up to 6-10 feet) limbs (living or dead) are cut to remove ground and ladder fuels.
Wildland Fuel Disposal Options (Alternatives B, C, and D)	
Pile Burning (machine or hand piles)	Piles are allowed to cure, covered with water repellent material, and ignited when fuel and weather conditions are right. Used to remove surface and ladder fuel component which reduces risk for broadcast burning at a latter date.
Pile and Leave (area would be broadcast burned within five years)	Piles remain on site longer but are removed over time. Wildlife considerations taken into account when leaving piles for longer duration.
Lop and Scatter	Vegetation is dispersed onsite and cut to maximize soil contact. Depth of material does not exceed 24 inches. Eventually consumed during broadcast burning. Drawback is that many saw scars may be visible until area is burned.
Chip and Broadcast (broadcast burn after fuel reduction)	Vegetation is chipped at landings or throughout treatment unit; chip depth, fuel moisture, and ignition pattern are considered in burn prescription development to mitigate smoke production and fire effects concerns.
Chip and Broadcast (leave one inch depth)	Chips are dispersed directly from chipper chute to avoid chip accumulations >1 inch, or chip piles are distributed

Technique Used for Hazard Fuel Reduction	Description
	by hand crews or machines to depth not to exceed 1 inch.
Chip and Haul (give for cost)	Chips are generated into a commercial chip van, or chips are piled and loaded into trucks for use as fiber or fuel. Chips can be donated for outside needs or hauled to sites in park but may also be sold or given away for cost.

Alternative A – No Action

Under the No Action Alternative, the existing direction and level of accomplishment of Yosemite National Park's fire management program as described in the 1990 *Fire Management Plan* would continue. This alternative would use a range of fire management strategies that include prescribed fire, managed wildland fire, fire suppression, and hand cutting followed by pile burning and prescribed fire.

The Fire Management Units for this alternative are the same as the "zones" used in the 1990 *Fire Management Plan*. Zone I, Prescribed Natural Fire Zone would become the Fire Use Unit; Zone II, Conditional Fire Zone would become the Conditional Unit; and Zone III, Suppression Zone would become the Suppression Unit (Map 2-19).

Since the inception of the fire management program in Yosemite, natural fire regimes have been restored and fuel build-up has been reduced in some areas, but not at the rate needed for comprehensive ecosystem maintenance and restoration. In the past, the park fire program has averaged 1,472 acres of prescribed burning and 2,567 acres of managed wildland fire each year. This does not approach the annual target of 16,000 acres that would need to burn annually to simulate natural conditions.

Over the last decade the park has reduced hazardous levels of fuels near developed areas, but the goal of providing an open defensible forest in and around every community may not ever be met at the current rate of work. Less than 25 acres per year in each of the larger WUI areas (Yosemite Valley, El Portal, Wawona, Foresta, Hodgdon Meadows, and Yosemite West) had been treated through 2001.

The current fire management program focuses on achieving hazard fuel reduction, reaching land management objectives such as a more open forest where appropriate, protecting developed areas and cultural resources, and restoring natural processes. Each fire is evaluated individually, under direction provided for each fire management unit. Unwanted fires are aggressively suppressed from the moment of detection. Factors that could lead to suppression include extreme drought, certain air quality and atmospheric conditions, and proximity to residential, administrative, or commercial areas. Past staffing levels and air quality constraints have limited the park's ability to complete larger landscape-scale prescribed fires and managed wildland fire projects.

Alternative B – Aggressive Action

Under Alternative B, aggressive techniques would be used to reduce fuels in and near developed areas (inner WUI) within a period of 5 years, and accomplish fire-related ecosystem restoration goals within 10 to 15 years. This alternative would reduce fuels on an average of 1,285 acres per year in the WUI (Maps 2-6 through 2-18) over 5 years (6,425 acres total). Aggressive fuel reduction methods would be used on less than 1% of the park. The natural fire regime would be restored to between 2,520 and 12,872 acres per year, for a total of between 31,503 and 160,894 acres over the next 10 to 15 years.

This alternative would treat WUI areas and accomplish restoration goals in the shortest time compared to other alternatives. Prescribed burning would increase dramatically over present levels and lightning fires would be allowed to burn where practicable. Median and maximum fire return interval departure analyses were used to determine locations and set annual goals (range of acres) for treatments, using the various restoration, maintenance, and fuel reduction strategies (Maps 2-4 and 2-5 and Table 2.5). Appendix 6 displays a multi-year burn schedule for ecosystem restoration, maintenance burning, and fuel reduction work in WUI areas.

Description of Actions under Alternative B

This alternative divides the park into two fire management units: the Fire Use Unit (83% of the park) and the Suppression Unit (17% of the park; Map 2-20).

Suppression Unit (17% of the park)

Wildland/Urban Interface Alternative B proposes the most aggressive treatments among all alternatives to reduce fuels, restore ecosystems, and protect people, homes, developed areas, valued resources, facilities, and utilities. A combination of physical removal of live and dead trees, shrubs, and woody debris, and prescribed burning would be used. Managers would aim to achieve the more dense forest structure within the natural range of variability for the system (see density/frequency ranges in Table 2.3), which would require the least amount of manipulation to achieve from the present condition.

It is expected that some secondary, or midstory, canopy trees in the 12”-20” dbh range would be removed from inner WUI forests to achieve the desired semi-open canopy condition. The reduction in forest stand density would reduce the risk of high-intensity wildland fire near communities and administrative and commercial areas in the 6,425 acres of the inner WUI.

This alternative would use the full range of options identified in Table 2.6 to remove some trees and shrubs, both live and dead, from areas near residences, commercial and administrative buildings, and other sensitive sites within public lands in the six core and inner WUI areas.

From the WUI community itself out to ¼ mile (inner WUI), mechanical methods would be used initially to accomplish fuel reduction objectives, followed by the use of prescribed fire. Where safe and practical to do so, prescribed fire could be used as the initial method rather than mechanical means. From ¼ mile to no more than 1½ miles from the WUI community (outer WUI), prescribed fire would be used initially to meet both fuel reduction and forest restoration objectives. Mechanical means to accomplish forest restoration targets in outer WUI areas would be used only

after prescribed fire had been shown to not accomplish these targets, and only after preparation of environmental compliance documents subject to public review.

Woody material would be chipped, burned, and/or removed from the areas to provide immediate protection and defensibility from wildland fire, unless leaving the material on site did not create a wildland fire hazard. Logs from thinning would be used within the park to the fullest extent possible for administrative and maintenance projects. Logs that cannot be used by the park would be removed following methods used by the Hazard Tree Removal program for many years. This would be a last resort for removal of this material.

One or more communities would be targeted each year over a five-year period, to complete fuel reduction for the six WUI areas (Maps 2-6 through 2-18). In the first year of treatment for each community, 90% of site preparation, tree and shrub reduction, and piling would be completed. It would be necessary to hire contractors, under the supervision of park staff, to complete the work this quickly. Prescribed burning would be completed within the next five years. A site-specific prescribed fire plan would be identified for each WUI area.

Most work would be scheduled during periods of low visitation, outside of the summer fire season. Pile burning would be simultaneous with tree and shrub removal, and would continue through fall and winter. After initial mechanical or prescribed fire reduction work was accomplished, prescribed fire units within the WUI areas would be set up for rotational burning to maintain an open forest structure.

Non-Wildland/Urban Interface, Non-Wilderness Beyond the 1½ mile radius around the six WUI areas, wildland fuel and vegetation would only be treated with prescribed fire to achieve target restoration and maintenance conditions. Hand thinning of live and dead tress would be done to prepare these areas for prescribed burning. After the initial fuel reduction work was accomplished, the prescribed fire units would be burned to maintain an open forest structure. Mechanical thinning of small trees less than 20" dbh would occur within 200' of the centerline of roads in areas where crowns are densely compacted.

Wilderness Areas Some of the identified WUI in Wawona is located within designated Wilderness. Aggressive fuel reduction with heavy equipment would not be performed in this or any other Wilderness area, nor could such equipment "reach over" from non-Wilderness to Wilderness land. Limited hand cutting, pile burning, and prescribed fire would be the tools available for reducing wildland fuels and for reaching ecological target conditions in the designated Wilderness area inside the Wawona WUI.

Fire Use Unit (83% of the park)

Managed wildland fire would be the primary tool to achieve fire-related ecosystem restoration goals in the Fire Use Unit. Occasionally, other passive fuel reduction treatments would be used for special needs, such as preparing an area for managed wildland fire. Certain areas within this unit would require treatment with prescribed fire before being fully eligible for managed wildland fire.

Non-Wildland/Urban Interface, Non-Wilderness There is very little development in this unit. These areas are located mostly along road corridors and include Glacier Point, Tuolumne Meadows, White Wolf, and other areas where the Wilderness boundary is set back from existing human intrusions and development. Prescribed fire and thinning of small trees generally less than

6" dbh would occur to protect these areas if wildland fire approaches. Hand cutting and pile burning would be used to prepare a prescribed fire unit for burning. Trees, including dead trees, would be cut as needed to provide safe and secure firelines.

These activities would be designed to reduce wildland fire intensity as fires approach non-Wilderness roads and utility corridors. Managed wildland fire would be acceptable where it did not endanger buildings or sensitive sites (e.g., cultural resources).

Table II-7
Fire and Mechanical Treatments Used in Alternative B by Unit

(an X indicates the treatment is used in the alternative and a bold X indicates extensive use)

ALTERNATIVE B	Suppression Unit			Fire Use Unit		
Treatment Strategy	**Wildland /Urban Interface**	**Non-WUI/ Non-Wilderness Corridors**	**Wilderness**	**Wildland /Urban Interface**	**Non-WUI/ Non-Wilderness Corridors**	**Wilderness**
Aggressive Reduction	X					
Passive Reduction	X	X	X	X	X	X
Managed Wildland Fire					X	X
Prescribed Fire (in prescribed fire units)	X	X	X	X	X	X
WUI = wildland/urban interface						

Wilderness Managed wildland fire would be the primary tool used to restore and maintain ecosystems. Hand cutting and pile burning would be used only to prepare units for prescribed fire or to protect developments from an approaching wildland fire. Fuels left after trail maintenance and clearing activities would be burned in piles in late fall or early winter. Prescribed fire plans would be prepared for designated prescribed fire units. Managed wildland fire would be permitted anywhere in the Fire Use unit, pending authorization of a wildland fire implementation plan (Appendix 3).

Alternative C – Passive Action

Under the Passive Action Alternative, efforts would be taken to decrease fuels in WUI areas within a period of 10 years and to accomplish ecosystem restoration goals throughout the park in 25 years. Under Alternative C, fuels would be reduced in WUI areas by an average of 766 acres per year (6,425 acres over 10 years) and the natural fire regime would be restored to areas that have missed four or more fire return intervals by treating between 1,260 and 6,436 acres per year (31,503 to 160,894 acres over 25 years). Prescribed burning would be increased over the current program, but not to the levels proposed in Alternative B. Fuel reduction would be accomplished by using passive reduction techniques and lower fuel profile treatments (Table 2.6).

This alternative would achieve goals over a longer timeframe than Alternative B, and fire managers would depend on lightning and associated managed wildland fire to play a greater role in ecosystem restoration. Despite the focus on ecosystem restoration, areas of the park could be consumed by large, high-intensity (and unwanted) wildland fires because of the hazardous levels of fuels that would remain until near the end of the planning period.

Under this alternative, it would take more time than under Alternative B, but less than under Alternative A, to accomplish the park's minimum goals for restoration and fuel reduction. By the time all areas were treated, many areas would have missed another fire or two; thus, the risk of stand replacement fire would remain high.

Median and maximum fire return interval departure analyses were used to determine locations and set annual goals (range of acres) for treatments, using the various restoration, maintenance, and fuel reduction strategies (Maps 2-4 and 2-5; Table 2.5). Alternative C proposes a long timeframe so the number of acres treated each year is the least among the action alternatives. Appendix 6 displays a multi-year burn schedule for accomplishing ecosystem restoration, maintenance burning, and fuel reduction work in WUI areas.

Description of Actions under Alternative C

This alternative divides the park into two fire management units: the Fire Use Unit (83% of the park) and the Suppression Unit (17% of the park; Map 2-20).

Suppression Unit (17% of the park)

Wildland/Urban Interface Under Alternative C, passive reduction mechanical techniques would be used to reduce tree density and hazardous fuel loads in the six core and inner WUI public land areas. Tree cutting to achieve ecological targets for specific vegetation types would be done by hand felling only. Thus, trees, branches, and shrubs would be removed more slowly under Alternative C than under Alternatives B and D.

No heavy equipment would be used and logs would be removed using low-impact methods (All Terrain Vehicles, horses, and fetching arches). Smaller trees and shrubs would be removed by hand cutting and pile burning or chipping to achieve the desired vegetation structure defined under restoration targets. Under this alternative, most work would be performed by inmate crews, volunteers, park fire crews, and the park forestry crew. The timeframe involved would allow the use of smaller crews.

The tools available for use in this alternative would limit the number of trees that could be removed annually in the 6,425 acres of inner WUI area.

Non-Wildland/Urban Interface, Non-Wilderness Beyond the 1½ mile radius around the six WUI areas, wildland fuel and vegetation would only be treated with prescribed fire to achieve target restoration and maintenance conditions. Thinning of live and dead tress would be done to prepare these areas for prescribed burning. After the initial fuel reduction work was accomplished, prescribed fire units would be set up for rotational burning to maintain an open forest structure. Thinning of small trees less than 20" dbh would occur within 200' of the centerline of roads where canopies are densely packed along road corridors and below utility lines.

Wilderness Prescribed fire would be the primary tool used to accomplish ecosystem restoration in designated Wilderness areas of the Suppression Unit, such as in part of Wawona. Hand piling would be used where prescribed fire is not safe. Chainsaws and other tools and equipment would have to meet the minimum tool requirements for Wilderness. Use of passive reduction techniques to remove trees less than 20" dbh in non-Wilderness within 200' of the centerline would be permitted along roads and utility corridors, and near buildings to protect them from wildland fire. Pile burning in late fall and winter would be used in areas where cutting has created fuel concentrations

Fire Use Unit (83% of the park)

Non-Wildland/Urban Interface, Non-Wilderness Passive reduction techniques would be used in non-WUI areas but would be restricted to non-Wilderness roads to keep them open, and under electrical utility corridors to mitigate wildfire occurrence and damage. Tree removal would be restricted to low-impact methods. Passive methods to remove dead and down material would be the primary tool used along with hand cutting and pile burning to prepare prescribed fire units for burning. Managed wildland fire would be used in this unit.

Wilderness Managed wildland fire would be the primary fire management strategy used in Wilderness. Hand cutting and pile burning would be used to prepare units for prescribed fire or to protect them from approaching wildland fire. Prescribed fire plans would be prepared for work in designated burn units. Managed wildland fire would be permitted anywhere in the unit pending authorization of a wildland fire implementation plan. Chainsaws and other equipment would have to meet minimum tool requirements.

Table II-8
Fire and Mechanical Treatments Used in Alternative C by Unit

(an X indicates the treatment is used in the alternative and a bold X indicates extensive use)

ALTERNATIVE C	Suppression Unit			Fire Use Unit		
Treatment Strategy	**Wildland /Urban Interface**	**Non-WUI/ Non-Wilderness Corridors**	**Wilderness**	**Wildland/ Urban Interface**	**Non-WUI/ Non-Wilderness Corridors**	**Wilderness**
Aggressive Reduction						
Passive Reduction	X	X	X	X	X	X
Managed Wildland Fire					X	X
Prescribed Fire (in prescribed fire units)	X	X	X	X	X	X
WUI = wildland/urban interface						

Alternative D – Multiple Action (Preferred Alternative)

Alternative D uses a combination of aggressive and passive fuel reduction techniques to achieve protection, fuel reduction, and ecosystem restoration goals. Under the Multiple Action Alternative, aggressive and passive treatment strategies would be used in the six inner WUI areas, while prescribed fire and wildland fire would be used to achieve ecosystem restoration goals in other areas. Alternative D achieves fuel reduction and target restoration objectives more quickly than Alternative C, but less quickly than Alternative B.

The Multiple Action Alternative is the National Park Service's Preferred Alternative. It would decrease fuels in WUI areas over a period of 6 to 8 years and restore fire to the ecosystem in 15 to 20 years. This alternative would reduce fuels on up to 1,095 acres per year in the inner WUI (6,425 acres total) and would restore the natural fire regime by treating between 1,817 and 9,194 acres per year (31,503 to 160,894 acres total).

Alternative D would require more time to accomplish WUI protection and ecosystem restoration than Alternative B, but less time than Alternative C. Median and maximum fire return interval departure analyses were used to determine locations and set annual goals (range of acres) for treatments, using the various restoration, maintenance, and fuel reduction strategies (Maps 2-4 and 2-5; Table 2.5).

Appendix 6 displays a multi-year burn schedule for accomplishing ecosystem restoration, maintenance burning, and fuel reduction in WUI areas. Work would be accomplished with a combination of fire crews, the park forestry crew, and some contract labor.

Descriptions of Proposed Actions under Alternative D

This alternative divides the park into two fire management units: the Fire Use Unit (83% of the park), and the Suppression Unit (17% of the park; Map 2-20).

Suppression Unit (17% of the park)

Wildland/Urban Interface Alternative D would combine aggressive and passive techniques to remove hazardous fuels and restore target forest conditions in the identified time frames, which are slower than Alternative B but faster than Alternative C. In areas close to development in the six WUI communities (i.e., inner WUI areas) mechanical methods would be used to remove trees up to 12" dbh to reduce tree density. In some areas, shrubs and ladder fuels would be removed to improve the defensibility of the communities. Passive methods would generally be used to thin vegetation up to 12" dbh to reduce hazardous fuels, while aggressive methods would generally be used to restore forest target conditions in the inner WUI. Aggressive methods could be used to concurrently reduce hazard fuels and restore target conditions in sensitive inner WUI sites to eliminate the need for more than one entry into the site with aggressive tools.

Thinned areas would generally be broadcast burned after an initial mechanical fuel reduction treatment. However, where safe and practical, prescribed fire would be used as the initial fuels treatment. Woody material, such as logs generated during implementation of mechanical methods, would be used within the park to the fullest extent possible. Otherwise, logs would be removed following methods used by the Hazard Tree Program for many years, but only as a last

resort if material could not be burned, chipped, or used inside the park, and did not pose a fire hazard if left on site.

Passive reduction techniques would be used in highly sensitive locations of the WUI (i.e., cultural sites, important wildlife habitat, or areas with highly erosive soils). These areas would be identified during the preparation of the operational plan; the plan would be given interdisciplinary review by park archaeologists, biologists, and other specialists Alternative D would use different treatments depending on the level of risk, sensitivity of the area, and associated values to be protected.

Non-Wildland /Urban Interface, Non-Wilderness Beyond the 1½ mile radius around the six WUI areas, wildland fuel and vegetation would only be treated with prescribed and managed wildland fire to achieve target restoration and maintenance conditions. Thinning of live and dead tress would be done to prepare these areas for prescribed burning. After initial fuel reduction work was accomplished, prescribed fire units would be set up for rotational burning to maintain an open forest structure. Passive thinning of small trees less than 20" dbh would occur within 200' of the centerline of roads and under utility lines where canopies are closely packed.

Wilderness Prescribed fire would be used generally to accomplish ecosystem restoration work in designated Wilderness areas of the Suppression Unit, such as near Wawona. Hand thinning and pile burning would be used where prescribed fire would not be safe. Limited passive reduction techniques would be used in non-Wilderness within 200' of the centerline along road and utility corridors, generally on shrubs and tress less than 20" in diameter; all heavy mechanical equipment would remain outside the Wilderness boundary, and would not "reach over" from non-Wilderness to Wilderness areas. Equipment used in the Wilderness would need to meet the minimum tool requirements for Wilderness.

Fire Use Unit (83% of the park)

Non-Wildland/Urban Interface, Non-Wilderness: There is very little development in this unit. These tracts are located mostly along road corridors and include Glacier Point, Tuolumne Meadows, White Wolf, and other areas where the Wilderness boundary is set back from existing human intrusions and development. Prescribed fire and thinning of small trees generally less than 6" dbh would be done to protect these areas as a wildland fire approaches. Hand cutting and pile burning would be used to prepare a prescribed fire unit for burning. Trees, including dead trees, would be cut as needed to provide safe and secure firelines. These activities would be designed to reduce wildland fire intensity as fires approach non-Wilderness road and utility corridors. Managed wildland fire would be acceptable where it did not endanger buildings or sensitive sites (e.g., cultural resources).

Wilderness Managed wildland fire would be the primary fire management strategy used in Wilderness. Use of equipment would meet minimum tool requirements for Wilderness. Hand cutting and pile burning would be used to prepare units for prescribed fire or to protect them from approaching wildland fire. Prescribed fire plans would be prepared for work in designated burn units. Managed wildland fire would be permitted anywhere in the unit pending authorization of a Wildland Fire Implementation Plan.

Table II-9. Fire and Mechanical Treatments Used in Alternative D by Unit
(an X indicates the treatment is used in the alternative and a bold X indicates extensive use)

ALTERNATIVE D	Suppression Unit			Fire Use Unit		
Treatment Strategy	**Wildland/ Urban Interface**	**Non-WUI/ Non-Wilderness Corridors**	**Wilderness**	**Wildland/ Urban Interface**	**Non-WUI/ Non-Wilderness Corridors**	**Wilderness**
Aggressive Reduction	X					
Passive Reduction	X	X	X	X	X	X
Managed Wildland Fire					X	X
Prescribed Fire (in prescribed fire units)	X	X	X	X	X	X
WUI = wildland/urban interface						

Public Information and Education

There would be an active partnership among Fire Management, Interpretation, and Resources Management staff to promote fire education among park staff and visitors. Fire education would be a component of interpretive staff training. Throughout the year, interpreters would incorporate wildland fire management and the role of fire in ecosystems into interpretive walks and evening programs. An exhibit would be located in the Yosemite Valley Visitor Center to provide education regarding wildland fire and its role in parks and Wilderness. Mobile exhibits would be developed as fire management projects are developed.

During fire season, as staffing allows, interpreters would be present at significant prescribed fires or managed wildland fires near visitor use areas to provide educational services. Where fires are particularly visible from major park scenic overlooks or traditional high use visitor areas (such as Glacier Point), a roving Fire Information Officer, qualified personnel, or trained park interpreters would give talks about fire and smoke. Updates would be posted in the park's Daily Report.

The Office of Media Relations would notify adjacent communities by press release before some prescribed fires are implemented. Media Relations would work closely with visiting Fire Information Officers, who may be part of an Incident Management Team or Fire Use Management Team, to assure that information is delivered effectively. Prompt reply to all media and public queries would be an essential element of public information. Information about wildland fire and smoke would be readily available, as would information about the fire management plan and ecosystem restoration if appropriate.

During emergency wildland fire situations, park interpretive staff could be brought in from other districts to assist in providing information to visitors and to assist the incident information officer. A smoke communication strategy (Appendix 4) would be used during fire management activities as a blueprint for managing smoke events and communicating with communities and other agencies.

Utility Corridor Treatments

Wildland fires caused by aerial or overhead electric power transmission and distribution lines have a propensity for becoming much larger and more damaging than fires from any other cause in California. Power line-caused fires become conflagrations because during the long, hot, and dry

fire season commonly experienced in California, the high winds and high temperatures that cause power line faults (unwanted short circuits for electric current) also lead to rapid spread and high resistance to control of wildland fire. Almost all of the aerial utility lines in Yosemite National Park are in the lower elevations (lower montane forests and woodlands vegetation types) where fire return intervals and fuel accumulations are at hazardous levels.

Vegetation under aerial overhead utility lines including electric transmission and distribution lines within the park (Map 3-5 and Table 2.10) would be thinned to reduce potential for fire starts and to meet code requirements. Trees growing or anticipated to grow within ten feet of the lines, and trees which show signs of falling on lines would be trimmed or taken down. Limbs, shrubs, and ground fuels beneath hazardous areas would be removed. Vegetation cut along these corridors would be removed to protect the utility infrastructure in the event of wildland fires (planned or unplanned) and to facilitate fire control.

In accessible areas, woody debris would be removed to landings or wood yards and in inaccessible areas it would be piled and burned. In heavily wooded inaccessible areas, clearings would have to be created for burn piles. Large tree boles in inaccessible areas would be limbed and bucked for maximum soil contact to increase moisture and accelerate natural decomposition. Utility workers would access power lines directly in areas accessible by road, and be confined to specified service roads in roadless areas. Tree work in Potential Wilderness Additions would be subject to the Wilderness minimum tool requirement decision process.

Table II-10 Utility Corridors Subject to Tree Hazard Mitigation and Vegetation Management Activities

Corridor/Site Name	Location	Special Concerns
Electric Transmission Lines		
Exchecquer Transmission Line	El Portal to Cascades Powerhouse	72Kv Wild and Scenic River
Electric Distribution Lines		
Fish Camp	From boundary near Summerdale Campground to South Entrance	Archeological sites
Big Trees (Mariposa Grove)	From South Entrance to Upper Mariposa Grove	Potential Wilderness Addition Giant sequoias Cultural Landscape
Meadow Loop	From South Entrance to Wawona	Wetlands
Wawona	Throughout Section 35 and western Wawona	Wild and Scenic River Archeological sites Mixed land ownership
Indian Flat	Throughout El Portal and Foresta	Wild and Scenic River Archeological sites Mixed land ownership
El Portal	Throughout western El Portal	Wild and Scenic River Archeological sites
Cascades	From Cascades to Big Oak Flat and Wawona Tunnels	Wild and Scenic River
Yosemite Valley	Mostly underground, some aerial	Wild and Scenic River
Glacier Point	From Yosemite Valley to Sentinel Dome	Potential Wilderness Addition
Hodgdon Meadow	Big Oak Flat Entrance to Hodgdon facilities	Traverses Campground
Telephone Lines		
South Entrance	South Entrance to Lower Mariposa Grove	Giant sequoias
Wawona	Throughout Section 35 and western Wawona	Mixed land ownership Archeological sites
El Portal	Throughout Administrative Site	Archeological sites T1 communication line
Yosemite Valley	From Cascades along Southside Drive and	Archeological sites

Corridor/Site Name	Location	Special Concerns
	throughout eastern Yosemite Valley	
Foresta	Throughout Foresta Town Planning Area	Archeological sites
Communication Equipment Sites		
Wawona Point	Upper Mariposa Grove of Giant Sequoia	Park radio net
Henness Ridge	Yosemite West	Park radio net Historic structure
Sentinel Dome	Glacier Point Road	Park radio net
Turtleback Dome	Above Yosemite Valley along Wawona Road	Park radio net
Crane Flat	Helibase	Park radio net Historic structure

Mitigation Measures

To ensure that the action alternatives protect natural and cultural resources and the quality of the visitor experience, a consistent set of mitigation measures would be applied to actions proposed in this plan. The National Park Service would complete appropriate environmental review (i.e., as required by NEPA, the National Historic Preservation Act, the Endangered Species Act and other relevant legislation) for future actions not covered in the *Final Yosemite Fire Management Plan/EIS*. As part of the environmental review, the NPS would avoid, minimize, and mitigate adverse impacts to the greatest extent possible. A Biological Opinion issued by the U.S. Fish and Wildlife Service, including mitigation actions, is included in Appendix 9.

Natural Resources During the planning phase of any fire management activity, the presence or absence of special-status species in the area would be determined. Park subject matter experts would evaluate existing databases and maps, and, if necessary, request additional surveys or field verification. Site-specific mitigations would be developed and implemented consistent with the mitigation measures identified in Appendix C of the Biological Opinion (Appendix 9 of this document). If a project could cause an adverse impact on federally listed species, consultation with the U.S. Fish and Wildlife Service is required. Managed wildland fires would be constrained if they pose undesirable disturbance to important habitat for special-status wildlife or threaten populations of special-status plants.

During any fire management activity, impacts to soils would be minimized by using the best available technology, the minimum tool, avoidance of sensitive areas, and by rehabilitation of disturbed soil. If mechanical treatments were prescribed, methods and equipment as described in "Understory Biomass Reduction Methods and Equipment" (USFS 2000b) would provide guidance. Disturbed soils would be rehabilitated by restoring slope contour and using other best practices. Areas with a high probability of erosion would be stabilized using best available methods, as determined by the park's Resource Management Staff.

Fire management activities can create disturbance, and there is potential for fire projects to result in opportunities for non-native plant species to colonize or spread into disturbed areas. Sites would be surveyed before and after prescribed fire and mechanical fuel reduction to determine the presence or absence of non-native plant species. The Division of Resource Management would develop a list of high-priority target species, and surveys for such species would be conducted prior to fire management actions. If high priority target non-native plants were discovered on a project site, the Fire Ecologist and park Vegetation Management Specialist would develop appropriate mitigation measures.

Snags and Slash Generally, snags (dead trees) and other standing vegetation would not be cut during fire management activities unless they presented a threat to human life or safety, or presented a hazard to property or a valued resource. They may also be cut to control a wildland fire. If it was necessary to cut down a snag or live vegetation, the stump would be cut flush with the ground (as close to the ground as possible).

Debris from cut vegetation would either be removed from the site, lopped and scattered to a depth of no more than 24 inches and burned during a subsequent prescribed fire, piled and burned outside of fire season, or chipped on site. If chipped, the chips would be spread on site at a depth of no more than one inch, hauled for use elsewhere in the park, or transported to a commercial plant for processing. Disposal methods would depend on the amount of material to be disposed of, land use regulations, proximity to existing roads, and need for chipped wood outside or inside the park.

Air Quality All proposed prescribed burns would adhere to requirements of Title 17 California Code of Regulations regarding Agricultural Burning Guidelines, as well as regulations developed by Tuolumne County Air Management District, Mariposa County Air Management District, and/or San Joaquin Unified Air Management District, all of which have jurisdictional boundaries within Yosemite National Park. Additionally, park staff would monitor air quality adjacent to project areas and within developed areas of the park. Unhealthy or hazardous accumulations of smoke may trigger an aggressive management action that includes completely extinguishing the fire. When adjacent land management agencies are managing prescribed fires or wildland fires, cooperation and coordination would be initiated to minimize cumulative smoke impacts. The Smoke Communication Strategy would be employed if fire management activities could produce smoky conditions near populated areas (Appendix 4). This strategy outlines a series of steps that the agency would take to notify the public and other agencies of increasing degradation of the air.

Cultural Resources During planning for any fire management activity, cultural resource specialists would review available information to determine the presence, absence, or likelihood of occurrence of significant cultural resources. Consultation would be initiated with park-associated American Indian tribes if there is potential for occurrence of resources of traditional significance. If little or no data are available, and if there is potential for significant resources to occur within the fire management area, additional inventory for such resources would be conducted.

Significant resources that could be affected by fire or fire management activities would be assessed for risk conditions and site-specific mitigation measures would be developed. Mitigations could include manually reducing fuel loads on or adjacent to resources, documenting flammable resources, identifying and avoiding archeological sites during ground-disturbing activities, and collecting at-risk artifacts or materials.

For traditional resources, mitigation would include measures such as coordinating fire management activity to allow for traditional gathering prior to burning, developing burn prescriptions to foster desired plant characteristics, or protecting sensitive resources from fire. Managed wildland fires may be constrained if they have potential to significantly impact or destroy important cultural resources. Given the limited response time and potential for loss or damage to significant cultural resources in wildland fire situations, a proactive program of inventory, hazard assessment, and fuel reduction would be implemented.

Cultural resource specialists would participate in fire management activities where necessary to reduce or avoid impacts to cultural resources, and where there is potential for resources to be discovered during activity. Post-burn assessments would be made to document the changed condition of known resources. In some cases post-burn inventory would be conducted to document newly exposed resources.

Since data are limited on effects of fire on cultural resources, fire effects research and monitoring will be developed in conjunction with regional and National Park Service initiatives. Information resulting from cultural resource activities conducted in support of fire management would be incorporated into existing resource information systems. These activities would be reported as part of the annual program or as project-specific documentation.

Visual Impacts Aesthetic impacts would be judged on a case-by-case basis; any mitigation measures would be approved by the park Superintendent.

Safety and Human Impacts Impacts to visitors, employees, and park residents would be minimized by planning fire management activities during daylight hours and on workdays whenever possible. Before starting any project, the public and employees would be notified of proposed activities through road signs, trail signs, postings at visitor centers, entrance stations, post offices, or other areas of frequent use.

Communication/Coordination Communication, cooperation, and collaboration with neighboring agencies and communities, park partners, visitors, residents, and employees would be an essential component of all plans for fire management activities. Communication with adjacent agencies would be conducted when projects occur at or near their boundaries or when there is an identified impact that might or would affect park neighbors.

Protection of Sensitive Resources

Yosemite has a variety of special places and sensitive cultural and natural resources. If known sensitive cultural resource sites or habitats for a special-status species are within any proposed prescribed fire or managed wildland fire area, the area would be evaluated and suitable mitigation measures would be applied as needed.

Prescribed fire protocols require that resource specialists be involved in the project review process. On-the-ground inventories of prescribed fire units would take place as necessary. If inventories are required, burning would be delayed until the inventory and suitable mitigation was completed. If a prescribed fire unit has potential to provide habitat for special-status species, steps would be taken to work around nesting season and other sensitive periods of time for animals and plants. This would be done by altering the time of burning, providing direct protection of certain areas such as nesting trees, or simply not allowing fire into parts of the unit.

With wildland fires, which are unplanned events, resource advisors would be notified of the intent to manage a fire in a certain part of the park. The location of the ignition would be reported and efforts would be made to get specialists into the area to perform basic inventory work as part of the cost of the incident.

If features are located that require mitigation, *action points* (geographic locations at which, if the fire reaches them, an action to mitigate is triggered) would be established and mitigation plans would be developed. Once the fire reached the action point the mitigation plan would be implemented. It could take several days to weeks before these actions were needed and the fire may not ever reach the identified resource at risk. The *maximum manageable area* (MMA) could also be set to exclude resources of concern.

Non-Native Species Management Activities

Non-Native Species Control Fire can be an effective tool in managing some non-native species. However, the *Yosemite Fire Management Plan* is not the primary planning instrument for control of non-native species. If the Resources Management Division prepares a non-native species control plan that recommends the use of fire, or requests specific burns be conducted to manage non-native plants, the fire management office would prepare a prescribed fire plan. This plan would include fire prescriptions, site preparation plans, and monitoring needed to help carry out the non-native species control plan.

Non-Native Species Invasion and Fire Management Activities There are occasions when fire management activities contribute to the invasion of non-native species. For example, in some areas, the timing of prescribed burns has contributed to the invasion of non-native thistle. As a result of knowledge gleaned through monitoring, prescribed burns in these areas are now scheduled for seasons when invasion is not enhanced by fire. Monitoring for non-native species would continue and, as the Resources Management Division identifies practices in the prescribed fire program that require modification, changes would be made.

Air Quality/Smoke Management

With all actions in Yosemite National Park or the El Portal Administrative Site involving prescribed or managed wildland fire, there would be strict adherence to state and federal regulations. This process mandates consultation with California Air Resources Board (CARB) and local (county) Air Pollution Control Officers (APCO), and other federal and state agencies that are involved with similar land treatments.

Ignition of prescribed fires would only be done on "burn days" or would be allowed by a variance from the county air pollution control officer. Visual aspects of the smoke column and/or particulates would be monitored for all prescribed fires. Air quality monitors would be placed at strategic locations and smoke sensitive areas when appropriate. Monitoring data would be available to the county Air Pollution Control Officers upon request.

A Prescribed Fire Plan, including smoke management, would be provided to the Air Pollution Control Officers prior to a burn so that a burn permit can be issued. Coordination with neighboring agencies would assure that the airshed is shared. This would normally mean that Yosemite would not be burning the same day as a neighboring agency, or that there would be adequate distance between the burn units for smoke dispersion.

Air Quality Watershed Strategy Smoke movement patterns have a direct relationship to watersheds, especially below 7,500 feet, since smoke tends to collect and flow downstream at night. Air quality watersheds of Yosemite are shown on Map 2-22. Smoke from lower elevation

fires (below 7,500 feet) can be intense and tends to move downslope, settling and concentrating down valley from a fire. Fires above 7,500 feet rarely cause smoke problems because of different fuel types that tend to have a slow rate of fire spread.

The park would likely control new starts within an air quality watershed that already had a wildland fire being managed within it, if the new starts would result in a violation of PM-10 health standards. For example, if a large fire is burning in the Illilouette Creek drainage, it is possible that no other fire would be allowed to burn in that drainage or in the adjacent Merced River, Tenaya Creek, or Yosemite Creek drainages, which all flow into Yosemite Valley. Similar relationships exist for the Bridalveil Creek area, the area around Hetch Hetchy Reservoir, and the South Fork of the Merced River.

Coordination with neighboring agencies would be initiated if the agencies had wildland fires in the same drainage that have potential to cause significant smoke problems. A decision would be made to either control one or more of the fires or to mitigate the amount of emissions that would be produced. For example, holding actions applied to one or more flanks of a fire will herd it into higher elevations where fuels are sparser and fire activity, and thus smoke production, is not as intense.

Smoke Problems A smoke problem is considered to be any level of smoke that generates complaints. Mitigation of smoke problems will occur through scheduling, public notification of planned and ongoing projects, and subdivision of projects with handlines to facilitate control. "Burn day/no burn day" determinations are made by meteorologists at the California Air Resources Board and passed on to the county Air Pollution Control Officers and park fire personnel. However, it is not uncommon for a burn to be ignited during excellent conditions but persist so long that the atmosphere stabilizes and causes a smoke problem. In the event of heavy smoke accumulations, the public would be notified as per the Smoke Communication Strategy (Appendix 4).

Roads and Trails Used for Fire Protection

Trails and roads closed to vehicular traffic because of Wilderness designations will not be driven on unless approved by the Superintendent.

Roads and trails enable fire personnel to get to a fire rapidly. Roads, trails, and utility corridors within the park provide access for monitoring and control of wildland fires. Roads and trails are used as boundaries for prescribed burns, anchor points for constructing fire line, and as fire line. To be useful, maintenance would be done to keep the main road corridors open and in a condition that provides for firefighter safety as a defensible fire line.

Maintenance would be done to keep road (but not trail) corridors free from fuel accumulation. Removing brush and downed trees also would reduce the risk of a fire crossing a road and threatening another area or becoming established below firefighters. The work would thin trees and shrubs less than 20" dbh up to 200' from the centerline of roads in the Suppression Unit. Aggressive methods for roadside thinning will not be used in Wilderness.

Roads treated (map 2-24) would include the El Portal Road (Highway 140), Big Oak Flat Road (Highway 120), and Wawona Road (Highway 41) in the Suppression Unit; Glacier Point, Hetch Hetchy, Mariposa Grove, and Aspen Valley roads; public roads in five WUI communities

(Yosemite Valley is excluded); and fire motorways shown on Map 2-23. Table 2.11 displays roads and trails that are commonly used as fire access for summer wildland fires and as control lines for prescribed fires. **No new roads would be created anywhere in the park for thinning operations.**

Since many of the roads and trails are important cultural resources, maintenance activities would be designed with guidance from Resource Management and Resource Protection to preserve important historic characteristics and to avoid impacts to contributing features. Work along utility corridors also would be conducted to avoid impacts to cultural resources.

Maintenance would be done as needed, annually on some fire roads and every five to eight years on other roads. Most park trails are periodically maintained by Trail Crews to permit stock traffic and hiking access, and some of them are used as fire breaks when the need arises.

Table II-11. Roads and Trails Used for Fire Management Activities

Road Name	Location	Special Concerns
Maintained Fire Roads		
Aspen Valley Rd. to Wilderness Boundary		Historic Great Sierra Wagon Rd.
Chowchilla Mtn Rd. to USFS Boundary	Wawona to park boundary	historic Mariposa Rd.
Chowchilla Mtn/4-Mile Cut-off		historic road
Davis Cut-off		historic road
El Portal Saddle Hill Rd	Rancheria Ct to NPS Boundary	
Foresta Rd. to El Portal	Foresta	historic road
Garnett Ridge	Highway 120 to Crane Flat	potentially historic road
Henness Ridge Lookout Rd.	Azalea Lane to Henness Ridge Lookout	historic road and railroad grade
Henness Ridge Cut-off Rd.	Azalea Lane to 11 Mile Rd-South	potentially historic road
Hodgdon Meadow to Park Boundary	Hodgdon Woodyard Rd.	historic Big Oak Flat Rd
Koon Holler Rd. Extension	Koon Holler to SDA Cut-off Rd., Wawona	
Larke Lane Extension	North of Loop Rd to dead-end	
Slaughterhouse Rd.	From Golf Course to Big Creek, Wawona	potentially historic road
South Landing Rd .to USFS Boundary		potentially historic road
Swinging Bridge Rd. - North	Swinging Bridge to Chilnualna Rd., Wawona	potentially historic road
Tioga Gravel Pit Heli-Pad Rd.		
Tuolumne Grove Rd.	Crane Flat to Hodgdon Meadow	historic Big Oak Flat Rd.
Wawona Hotel Rd.	Highway 41 to Forest Drive	
Sequoia Grove Roads		
Merced Grove Rd.	From gate along Big Oak Flat Rd. to ranger cabin	historic Coulterville Rd. and railroad grade
Merced Grove Jct. to Park Boundary		historic railroad grade
Merced Grove Rd. - Hazel Green Spur		historic Coulterville Rd.
Mariposa Grove Fire Rd.	From Tram Rd. to USFS Rd 5S06	Potentially historic road
Clothespin Tree Fire Rd.	Museum to Tram Rd by the Clothespin Tree	historic road
Numbered Roads		
4 Mile Rd.	So. Entrance to Chowchilla Mtn Rd.	historic road
11 Mile Rd.	Hwy 41 to Henness Ridge Rd.	historic Wawona Rd.
11 Mile Meadow Rd-North	From 11 Mile Rd to north side of 11 Mile Mdw	historic Wawona Rd.
11 Mile Meadow Rd – South	From 11 Mile Rd to the NPS/Halsey property boundary	
Wilderness Trails		
SDA Cut-off Trail	Wawona	Closed to vehicles
SDA Camp Rd. from Hwy 41	Wawona	Closed to vehicles
YI to Gin Flat Trail	Off Tioga Corridor; historic Big Oak Flat Road	Closed to vehicles
School House Extension Hiking Trail	North from Chilnualna Falls Rd. to dead-end	Closed to vehicles

Monitoring

Fire Monitoring

Monitoring of wildland and prescribed fires involves systematic collection and recording of data on fuels, topography, weather, air quality, and fire behavior. Monitoring would generally follow the protocols outlined in the National Park Service Fire Monitoring Handbook (NPS 1992a). A fire monitoring plan is a required element in NPS fire management plans. The *Yosemite Wildland and Prescribed Fire Monitoring Plan* provides detailed descriptions and additional protocols for wildland and prescribed fires. This monitoring would be completed by the fuels and ecology group within the Branch of Fire and Aviation at Yosemite National Park and placed in the approved Yosemite Fire Management Plan; assistance would be provided by other park staff as needed.

Monitoring is key to successful understanding of wildland and prescribed fires. Development, evaluation, and refinement of restoration and maintenance target conditions for key vegetation types would help establish priorities for carrying out prescribed fires in the Suppression Unit (Tables 2.3 and 2.4). Measurement and analysis of plots, photo points, and vegetation transects would be used to indicate attainment or non-attainment of short- and long-term objectives. Monitoring data would be archived and reviewed for future refinement of target conditions and burn prescriptions and to determine program success and effectiveness.

Short- and long-term vegetation monitoring objectives applicable to a specific burn area would be stated in the prescribed fire plan. At a minimum, monitoring would comply with the protocol identified in the National Park Service Fire Monitoring Handbook. Data collected from short-term monitoring would be attached to the fire report along with any narrative completed by the prescribed fire monitors.

Cultural Resources Monitoring

The NPS recognizes that the effects of fire and the thresholds for unacceptable damage to some types of cultural resources (i.e., archaeological resources) are not well understood. An ongoing effort to obtain baseline information and develop this understanding will make it possible to refine risk management for fire planning. Monitoring the effects of fire in field situations would be an important component of this work. However, until systematic laboratory experiments can be conducted, field-based fire effects monitoring would be limited to empirical observations.

For resources such as cultural landscapes and historic districts, systematic fire effects research and monitoring would focus on indicators or criteria for landscape restoration and maintenance. All cultural resources fire effects monitoring efforts would be coordinated with those of the natural resource fire monitors to collaborate on methodology, ensure consistency in data collection, and take advantage of multidisciplinary applications of data.

Outlined below is the minimum level of effort for monitoring the effects of fire on cultural resources. This monitoring would provide feedback on the effectiveness of current resource protection measures, such as site avoidance and pre-burn fuel load reduction. This monitoring would be designed to document pre- and post-burn resource conditions that are readily observable, such as preservation of flammable historic fabric, preservation of milling slicks on

archaeological sites, visually identifiable changes in surface artifacts and surface conditions, and changes in landscape conditions in historic districts and cultural landscapes.

As systematic processes for evaluating fire effects evolve, monitoring would be revised to support field evaluation. In the interim, cultural resource specialists (usually archeologists) would identify any necessary pre-burn mitigation, resource protection measures, and the most appropriate monitoring strategy for planned and unplanned burns. In general, these would consist of the following:

Pre-burn Prior to a prescribed burn, known cultural resources would be located and current conditions would be assessed, using standard operating procedures. This would include documentation of current fuel loads, likely duration and intensity of a fire, threats to features and artifacts, and potential for subsurface impacts through burning roots and stumps. These data would be assessed to determine: (1) which protection measures should be implemented (if any); (2) the potential for fire effects studies; and (3) additional monitoring needs. All three measures would be used on prescribed burns, while monitoring of managed wildland fires would typically begin after a fire started. Results of monitoring would enhance the understanding of the effects of fire and fire management activities on cultural resources. Burn prescriptions and techniques used to protect resources also would be refined accordingly.

During Burn Criteria for monitoring and protecting sites during burns are outlined in the standard operating procedures. For selected fires, an archeologist would be assigned as Cultural Resource Advisor or as a technical specialist providing recommendations to an interdisciplinary Resource Advisor. Although this would be primarily for resource protection, it also would provide documentation of fire behavior and immediately observable effects of fire in and adjacent to cultural resources. If suppression or holding actions were to be taken, the Cultural Resource Advisor would monitor as needed and advise on site-specific actions.

Post-burn An archeologist would revisit known cultural resources in burn areas to document any changes in condition and to assess post-burn protection needs. Fire effects to cultural resources would be documented and subsequently added to the database on cultural resource fire effects.

Research

Fire Research Program

The current fire management program is based on more than 30 years of scientific studies and research. As the program continues to mature, additional information will be needed to refine objectives and meet new challenges. New research needs and priorities would be identified by the Fire Management Office in conjunction with Yosemite's Resources Management Division and research scientists from the Western Ecological Research Center, Yosemite Field Station.

Information gaps in several areas have been identified. For example, the National Park Service needs to continue to improve its understanding of Yosemite's fire history, and data on fire return intervals, season of burning, and fire severity is needed for vegetation types other than the giant Sequoia and ponderosa pine types (Table 2.4). Research is needed to better understand the structural component of lower elevation vegetation types, thus providing a basis for target conditions. These features include gap distributions, species composition, and density. As new

remote sensing technologies develop, the fuel model map for the park would need to be refined, updated, and verified. Finally, additional information on the effects of fire on California black oaks, invasive non-native species, air quality, water quality, and sensitive species habitats would improve Yosemite's fire program. Research also is needed on the influence of topography and smoke dispersion, as well as on short- and long-term health effects from periodic smoke events.

Cultural Resource Research

To determine the most effective techniques for protection and preservation, Yosemite's fire management program must first understand more precisely how heat affects archaeological objects, how fire was used by indigenous people in managing specific plant resources and the pre-contact and prehistoric landscapes, and how fire can be used to restore and maintain historic and traditional cultural landscapes. These data would then be used to develop protocols to avoid or mitigate the potentially damaging effects of burning. The need for better data on fire effects on cultural resources is a nationwide issue (Table 2.12). All efforts to conduct fire effects research at Yosemite would be coordinated with the Pacific West Region, other NPS units, and other agencies.

Table II-12.
Sample of Cultural Resource Research Needs

Fire Effects	Research Needs	Sources of Information
Material Culture	Determine relationship between fire duration and temperature and effects on artifacts.	Conduct controlled laboratory experiments with different material types, different temperatures and length of heating, and record the threshold for damage or change. Record duration and temperature of fire and physical attributes of artifacts before and after fire.
Traditionally Gathered Plants	Determine how fire can be used to maintain traditionally gathered plants. Document the seasonality and frequency of burning necessary to create preferred plant characteristics.	Tribal consultation and literature review to bracket the range of desired conditions for traditionally gathered plants and frequency and timing of fires. Develop effective monitoring strategy for traditional gathered plants.
Wildland vs. Prescribed Fire	Determine whether nature and extent of effects to cultural resource differ between wildland fires and prescribed fires.	Compare expected effects of fire, based on projected burn temperature and duration differences between wildland and prescribed fires. Monitor fuel loads, current condition, and post-fire observations of cultural resources while recording duration and temperature of fire during managed wildland fires.
Effect of fire on obsidian hydration dating	Determine possible impacts of past fires on obsidian hydration data. Investigate the assumption that moderate fires, and their associated effects, have been sustained in the past.	Cross-reference fire scar and obsidian hydration dates on specific archaeological sites. Obtain information about site formation processes such as bioturbation, etc. that might obscure surface-evident changes in obsidian hydration data.
Cultural Landscapes	Determine the impact of cultural phenomena on the landscape (e.g., burning for American Indian purposes) to develop a better understanding of what a "natural" fire regime is.	Multi-disciplinary fire history data that compares areas of low frequency of prehistoric resources with areas such as major village concentrations, aboriginal trails corridors, etc.

A recent review and synthesis of literature on the effects of fire on cultural resources demonstrates that little systematic or rigorous research has been conducted on this topic (Ryan and Jones 1999).

Many studies (e.g., Eininger 1990) consist of post-fire observations that cannot be compared to pre-fire data, thereby limiting their contribution to understanding the direct and negative effects of burning. A smaller number of studies (e.g., Picha et al. 1991) have been carried out in conjunction with controlled burns.

These experiments compare post-burn observations to pre-burn data but often lack information about important variables such as site-specific temperature and duration of heating. Laboratory experiments, notably Bennett and Kunzman (1985), have been conducted to simulate fire effects on various artifact types. There is a need, however, to standardize controlled burn and laboratory experiments that measure the effects of fire on cultural resources. These studies need to account for variation within cultural resource material types as well as variation in fire and environmental conditions. The end goal of these studies is to predict the effects of heating, under various conditions, on archaeological objects and the resultant loss of important information.

In addition to the effects of heating on particular material cultural objects, there is a need to understand the extent and objectives of indigenous (American Indian) and historic fire-based management of plant and animal resources. Specifically, how fire-based management affected the distribution, abundance, and diversity of wildlife and plant life is not well understood.

Yosemite Fire Management Organization and Responsibilities

The fire management program in Yosemite National Park is directed by the Fire Management Officer (FMO). The FMO works for the Chief, Division of Visitor Protection, and supervises four specialists in charge of four functional areas. These areas are: wildland fire suppression/aviation, structural fire, prescribed fire/fire use, and telecommunications. Program management for each functional area is done by the specialists in coordination with the other specialists. Total coordination and integration with other park divisions is done by the FMO. All positions except the telecommunications position are involved with all facets of wildland fire management.

The Wildland Fire Specialist and the Structure Fire Specialist function as Battalion Chiefs; each supervises two fire stations that are run by Station Captains. Stations are located in Yosemite Valley, Wawona, El Portal, and Hodgdon Meadow. Each of the four primary stations has both wildland and structural firefighting equipment. The Valley Station is staffed with three permanent and two seasonal employees. The three boundary stations have a module of three permanent employees and, during wildland fire season, four seasonal employees. Two of the boundary stations are interagency stations; the U.S. Forest Service provides some seasonal employees, but work is directed by the NPS Station Captain.

The park also has an exclusive-use helicopter program that is supervised by the Wildland Fire Suppression Specialist. This person supervises a Helicopter Foreman, who supervises two additional permanent employees and five seasonal employees. The helicopter contract starts May 12th and ends October 20th. The aviation program engages in firefighting and search and rescue. The helicopter is flown within a pre-designated response area and normally is required to be back in the park by nightfall. In extreme-need situations, it can be requested to stay at an incident if not needed in the park.

The Prescribed Fire/Fire Use Specialist is responsible for planning and implementing prescribed fires, managed wildland fire activities, fuel management projects, and the fire ecology program. This program has eight permanent employees and numerous seasonal employees. It has an operations branch, a fire effects branch, and, during the summer, a fuels crew. The fire effects branch is the primary liaison between the fire management program and the Division of Resources Management. All historic records maintenance is done by the prescribed fire program.

Fire Reporting

Fire reporting follows guidelines established by National Park Service policy and Directors Order 18 and the associated reference manual, RM-18 (NPS 1998b, 1999b). All fires, regardless of type, are required to have a written report, which is tracked at the park and at national levels. As soon as a fire is declared "out", the report is finalized and delivered to the dispatch office where it is entered into a national database known as the Shared Automated Computer System (SACS). This system permits the entry of statistical data on wildland fire occurrence and the use of prescribed fire. It also permits a wide variety of screen queries and batch reports for the analysis of this data. The Department of Interior uses Form DI-1202 to report such fires. The Fire Occurrence System generates the report in this format. The following reports can be generated and printed in Boise, Idaho or at remote sites (not an inclusive list):

- Summary of Fires by Discovery Type
- Summary of Suppressed Fires/Size Class
- Summary of Suppressed Fires by Month
- Summary of Wildfires National Fire Danger Rating System (NFDRS) Risk Analysis
- Cause Analysis Reports
- Summary of Multiple Starts for Wildfires
- Fire Type Summary
- Fire Occurrence Summary; Wild or Natural
- Individual Fire Report by Park or Region
- Fire Occurrence Summary/Park or Region

Park fire activity is reported daily to the Geographic Area Coordination Center. This sharing of information is discussed in both the California Mobilization Guide and the National Mobilization Guide. The information is processed and shared with all fire agencies so all are aware of commitments of firefighters and equipment within the region and the nation. In California, like other regions, when a management unit reports a new start virtually every neighbor is aware of it. Common radio frequencies are monitored for information on the dispatch to that unit of equipment, personnel, and aircraft.

Fire Management Budgeting

The budget process for wildland fire funds is handled in a similar process for all national parks. Fire management funding for the NPS is derived from three sources:

FIREPRO funds are allocated by the Fire Management Program Center in Boise, Idaho, and managed through annual operating program accounts or through project work accounts, depending on the activity. Activities covered include preparedness activities, permanent staffing, training, monitoring, and equipment purchases. FIREPRO is intended to identify the minimum acceptable standards that each park fire management program should achieve. The FIREPRO analysis would be used as a vehicle for seeking adequate funding to implement these standards.

Operation of the National Park Service (ONPS) funds are used to support programs that were in place before FIREPRO and to provide enhanced fire management capabilities in many parks. In the event that adequate FIREPRO funds were not appropriated, parks need to supplement FIREPRO funding with ONPS funding to achieve minimum fire management capability. Parks might also use ONPS funds to augment the basic FIREPRO-funded preparedness operation to achieve a higher level of response capability or to retain a stronger initial attack capability outside the defined fire season.

Wildland Fire Operations funds within the NPS portion of the Department of Interior firefighting account could be insufficient to cover expenditures for suppression, severity, rehabilitation, and hazard fuels management during severe fire years. For these situations, the NPS would first request that the department transfer wildland fire management funds from other bureaus or, if these funds were exhausted, use the emergency authority under Section 102 of the general provisions of the Interior Appropriations Act to transfer funds from other programs. The National Park Service would then seek to restore funds to affected programs through a supplemental appropriation.

Alternatives Considered and Dismissed

For any project or activity in Yosemite National Park or the El Portal Administrative Site, a number of alternative actions could be considered. During the course of the public scoping process for the *Draft Yosemite Fire Management Plan/EIS*, several alternative actions were recommended by members of the public. Others were suggested by scientists, technical specialists, and NPS employees. While all were considered, and many were included as alternatives or elements of alternatives, some were eliminated from detailed study per 40 CFR 1504.14(a). Reasons for dismissing individual actions include the following:

- technical or economic infeasibility;
- inability to meet project objectives or resolve need for the project;
- duplicative with other less environmentally damaging alternatives;
- in conflict with an up-to-date and valid plan, statement of purpose and significance, or other policy; and therefore, would require a major change in that plan or policy to implement; and
- environmental impacts are too great.

Alternatives that were considered but dismissed include the following:

Suppress All Fires

This alternative was dismissed for several reasons, including its inconsistency with NPS and federal wildland fire management policy and Yosemite's *General Management Plan*, which calls for allowing fire and other natural processes to prevail. In addition, suppression of all fires throughout the park would fail to meet the purpose and need for revision of the *Yosemite Fire Management Plan,* which seeks restoration and maintenance of park ecosystems while protecting people, valued resources, and developed areas from fire. Although it would appear that suppression of all fires would help reduce risk and protect structures and developments, especially along the WUI, this path would ultimately lead to different outcomes. A return to the "suppress all fires" policy was dismissed because it would result in fuel accumulations and changes in forest structure that would increase (rather than reduce) the risk of uncontrollable, catastrophic wildland fire and the potential for loss of life and property.

Disallow the Use of Mechanical Fuels Treatment

This alternative was dismissed because of the need to retain options when developing strategies for the reduction of fuels and the risk of harmful wildland fire along the WUI. Years of fire suppression in Yosemite have resulted in the buildup of fuels and a change in the forest structure in many locations. The use of prescribed fire in these fuels near communities presents risks to both firefighters and to the communities. An additional risk is from smoke; air quality regulators have requested fire agencies to consider the use of mechanical fuel reduction methods in lieu of prescribed fire wherever possible.

Yosemite's *General Management Plan* recognized these changes in fuel and vegetation and directed the use of "controlled burning and mechanical removal of vegetation" to simulate the natural role of fire in developed areas. Disallowing the use of mechanical fuels treatment was dismissed because it would not likely be possible to achieve the purpose of the *Yosemite Fire Management Plan* if fire were the only tool available for vegetation and wildland fuel management, especially near WUI areas.

Use Mechanical Treatments Only

This alternative was dismissed because of its inability to meet park objectives and because it would be in conflict with NPS and other federal policies and mandates. Mechanical treatment is an effective method for restoring forest structure in locations where changes have occurred because of past fire suppression activities. It is also effective in reducing risks near WUI areas. However, even in these areas, prescribed burning is needed. Fire promotes nutrient recycling, exposes mineral soil, and maintains other ecosystem dynamics. With mechanical treatment only, resource management objectives would not be fully met.

"Mechanical treatments only" would not meet the test of minimum tool in the Wilderness portions of the Fire Use Unit, since managed wildland fire and prescribed fire can meet objectives in most of these areas. This alternative was dismissed from further consideration because thinning and other mechanical treatment would not further resource management objectives in most areas of the park.

Use of Different Target Conditions

Some public comments on the *Draft Yosemite Fire Management Plan/EIS* suggested that additional alternatives be considered that include targets based on the reduction from 31.5" to 20" dbh of the maximum diameter of trees thinned mechanically to achieve forest restoration target conditions in the six WUI areas. The 31.5" dbh tree size referenced in the comments is from the restoration target condition, which is based upon the management objective, "Manage ecosystems within the natural range of variability for plant community structure and fuel loads." All alternatives attempt to accomplish this objective. Therefore, although no tree greater than 20" dbh will be thinned mechanically to achieve forest restoration target conditions under this EIS, it is still the objective of the fire management program to achieve these target conditions, generally through the use of prescribed and wildland fire.

Approaches to Protecting WUI structures without fuel treatment.

One comment on the *Draft Yosemite Fire Management Plan/EIS* suggested that the range of alternatives was inadequate because it did not include simply using fire retardant foam or heat reflective tents to protect structures in the WUI. This comment was considered but not included in the *Final Yosemite Fire Management Plan/EIS* because it did not represent an alternative per se for managing fire to accomplish park and resource management objectives. It is a tactical option for protecting structures.

Environmentally Preferable Alternative

The environmentally preferred alternative is determined by applying criteria identified in Section 101 of the National Environmental Policy Act (NEPA) to each alternative considered. In accordance with the NEPA, the environmentally preferred alternative would best: (1) fulfill the responsibilities of each generation as trustee of the environment for succeeding generations; (2) assure for all generations safe, healthful, productive, and esthetically and culturally pleasing surroundings; (3) attain the widest range of beneficial uses of the environment without degradation, risk of health or safety, or other undesirable and unintended consequences ; (4) preserve important historic, cultural, and natural aspects of our natural heritage and maintaining, wherever possible, an environment that supports diversity and variety of individual choice; (5) achieve a balance between population and resource use that will permit high standards of living and a wide sharing of life's amenities; and (6) enhance the quality of renewable resources and approaching the maximum attainable recycling of depletable resources.

The National Park Service has considered all alternatives in this analysis in accordance with NEPA and CEQ regulations (CEQ Regulations, Section 1505.2) and has determined that Alternative 4: Multiple Action, as presented in the *Yosemite Fire Management Plan/Environmental Impact Statement* is environmentally preferable. After review of potential resource and visitor impacts, and developing mitigations for impacts to visitors as well as natural and cultural resources, the preferred alternative achieves the greatest balance between the restoration of wildland fire as a critically important ecosystem process and the protection of life, property, natural resources, and cultural resources from unwanted wildland fire.

Summary of Alternatives

Table II-13
Summary of Alternatives (Alternative A uses terminology from in the 1990 Fire Management Plan)

		No Action (Status Quo)	ACTION ALTERNATIVES		
		Alternative A	**Alternative B**	**Alternative C**	**Alternative D (Preferred)**
Theme of the Alternative		Continue current fire management programs and activity level	**Aggressive Action:** rapidly restore fire to ecosystems and reduce risks in wildland/urban interface areas.	**Passive Action:** restore fire to ecosystems and reduce risks in wildland/urban interface areas over greater time.	**Multiple Action:** variable approach to restoring fire to ecosystems and reducing risks to wildland/urban interface areas in an acceptable time frame. A full range of fuel-reduction techniques would allow flexibility in achieving habitat restoration goals.
# Years to Accomplish Objectives	**Ecosystem Restoration**	Not achieved at present level of activity	10 to 15 years (median = 7 years)	25 years	15 to 20 years (median=17.5 years)
	Wildland/Urban Interface (WUI) Protection	Objective not a high priority under the 1990 *Fire Management Plan*	WUI: 5 years	WUI: up to 10 years	WUI: 6 to 8 years Median = 7 yrs
Mean amount (acres) of annual accomplishment	**Wildland/Urban Interface**	Less than 100 acres per year for all developed areas	Approximately 1,285 acres treated per year with mechanical and prescribed fire methods	Approximately 766 acres treated per year with mechanical and prescribed fire methods.	Approximately 1,095 acres treated per year with mechanical and prescribed fire methods.
	Prescribed Fire	1,472 acres per year (over the past 29 years)	2,520 to 12,872 acres per year	1,260 to 6,436 acres per year	1,817 to 9,194 acres per year
	Managed Wildland Fire	2,567 acres per year (average over the past 27 years)	Maximize managed wildland fire with a target of 16,000 acres per year (all treatments) based on fire history indications (from research) of what would have naturally burned with no human interference.		
Acreage by Fire Management Unit		Fire Use Unit: 583,365 acres (75%) Conditional Unit: 59,496 acres (8%) Suppression Unit: 106,256 acres (17%)	Fire Use Unit: 621,059 acres (83% of park) Suppression Unit: 128,044 acres (17% of park) Under new National Park Service policy, the park is divided into Fire Management Units. The 1990 plan used the term *Zone* and divided the park into 3 Fire Management Zones. By applying the concept of Appropriate Management Response, the need for a "conditional" area is eliminated.		

	No Action (Status Quo)	ACTION ALTERNATIVES		
	Alternative A	**Alternative B**	**Alternative C**	**Alternative D (Preferred)**
Acreage in Prescribed Fire Units, by Fire Management Unit	Fire Use Unit: 57,630 acres Conditional Unit: 11,944 acres Suppression Unit: 86,245 acres.	Fire Use Unit: 48,912 acres Suppression Unit: 107,040 acres There are a total of 133 burn units		
Special Management Areas requiring management different then the general objectives of the Fire Management Plan	Sequoia Groves Boundary Areas Yosemite Valley	Sequoia Groves Boundary Areas Wildland/Urban Interface: (Wawona, Foresta, El Portal, east half of Yosemite Valley, Yosemite West, Hodgdon Meadow). For additional areas with single to multiple buildings see map 1-2. No new treatments in Tuolumne Meadows until a comprehensive management plan is developed for the Tuolumne Wild and Scenic River.		
TREATMENTS AVAILABLE UNDER EACH ALTERNATIVE				
Wildland Fire Use	Fire Use and Conditional Units	Fire Use Unit only. Wildland fires would be managed to accomplish resource management objectives and to maintain or restore ecological target conditions. Fire would be monitored. Holding and mitigating actions used as needed.		
Re-ignition	Not in this alternative	Allowed In Fire Use Unit only, in same year or within 3 years. Used to restore or maintain target conditions and take advantage of the natural selection process. Some extinguished fires may be modeled and burned later using prescribed fire.		
Prescribed Fire	Conditional and Prescribed Fire Units primarily	Fire Use Unit and Suppression Unit. Prescribed fire would be used separately or in combination with other treatments, to restore target conditions in the Fire Use Unit, and to restore and maintain target conditions in Suppression Unit and Special Management Areas.		
Aggressive Reduction Techniques Mechanized Tree/Shrub Removal (feller bunchers, forwarders) Conventional Tree/Shrub Removal (saws, skidders, grapplers), Machine crush, shred, Machine Pile	Not in this alternative	Used in Suppression Unit. Only used near six developed areas (inner WUI) to restore forest community structure and to remove hazard fuels. Normally followed by prescribed fire.	Not in this alternative	Used in Suppression Unit. Only used near six developed areas (inner WUI) to restore forest community structure. May be used to reduce hazard fuels in the inner WUI. Normally followed by prescribed fire. Rate of restoration slightly slower than Alternative B.
Passive Reduction Techniques Yarding Hand Cutting/Piling Cutting/Chipping Low- Impact Skidding Girdling Limb Removal (trees left standing)	Several of these techniques (chipping, cutting and piling, limb removal) were experimented with during the life of the existing *Yosemite Fire Management Plan*. The main goal was to reduce the amount of fuel that was burned by broadcast burning so that impacts to air quality were reduced. High quality cedar	Used in the Suppression Unit and the Fire Use Unit where there is no need for the use of mechanized tree removal. Used to restore plant community structure in the developed areas, or clear roadsides and utility lines of small trees. Used in Wilderness only after meeting minimum tool requirements. Many of these techniques are follow-up or	In the Suppression Unit as the primary method to reduce tree density in the wildland/ urban interface, or along roadsides and utility lines, In the Fire Use Unit to remove some trees from developed areas to prepare for management of wildland fire. Many of the techniques are used alone (cutting and piling, cutting and chipping) to prepare a	Used In the Suppression Unit as the primary method to reduce tree density in the wildland/ urban interface, or along roadsides and utility lines, Many of the techniques are used alone (cutting and piling, cutting and chipping) to prepare a prescribed fire unit for burning at a latter date. Used in Wilderness only after meeting minimum tool requirements, and for the

		No Action (Status Quo)	ACTION ALTERNATIVES		
		Alternative A	**Alternative B**	**Alternative C**	**Alternative D (Preferred)**
		chips were made available to locations within the park and to outside markets for the cost of hauling only.	accompany aggressive reduction techniques. Many of the techniques are used alone (cutting and piling, cutting and chipping) to prepare a prescribed fire unit for burning.	prescribed fire unit for burning at a latter date. Used in Wilderness only after meeting minimum tool requirements.	management of a wildland fire.
	Wildland Fuel Disposal Options: Low-Impact Skidding Pile Burning Pile and Leave Lop and Scatter Chip and Broadcast (burn) Chip and Broadcast (<1")	Experimented with successfully in areas under the 1990 plan	These techniques would be used in all alternatives in both the Suppression Unit and the Fire Use Unit. These support techniques would accompany actions discussed above or they could be used alone depending on the amount of tree or shrub removal needed. No heavy equipment would be used in Wilderness. Chainsaws would be used in Wilderness only after meeting minimum tool requirements.		
Smoke Management		Managed wildland fire: Control decisions based on smoke conditions— permitted only under favorable conditions, as negotiated with the county air pollution control district. Prescribed fire: Ignitions under favorable conditions, as negotiated with the county air pollution control district.	Managed wildland fire: Smoke managed under a watershed strategy to control effects. Additional starts in the watershed, affecting the same downwind targets, could be controlled or managed depending on current and potential level of impact. Fire use only under favorable conditions, as agreed to by the county air pollution control district. Prescribed fire: Ignitions made only under favorable conditions, as agreed to by the county air pollution control district.		
Standard Mitigations		Surveys and protection of special status species and known critical habitat. Cultural resource protection, preservation, or mitigation. Adherence to Title 17, California Code of Regulations regarding Agricultural Burning. Rehab of disturbed soils, through slope contouring and best available practices. Cutting of snags and standing vegetation only if a threat to life and safety or to controlling burns. Trimmed Vegetation will be either: Piled ("car size") and burned Chipped on site and broadcast, no greater than 1" depth Lopped and scattered, no greater than 18" depth, and subsequently broadcast burned Treatments timed to discourage invasion of non-native species. Case-by-case measures to limit impacts to aesthetic values. Communication measures to inform visitors, residents, adjacent land managers, and county fire protection personnel.			
Fire Monitoring		All vegetation and fuel effects monitored, using established protocols, by fuels and ecology experts. All cultural resources effects monitored, using established protocols, by cultural resource experts. Results used to revise prescriptions and application procedures according to adaptive management strategy. Monitoring program evolves as needed to understand and interpret effects.			

	No Action (Status Quo)	ACTION ALTERNATIVES		
	Alternative A	**Alternative B**	**Alternative C**	**Alternative D (Preferred)**
Fire Research	Information gaps identified, and communicated to USGS Biological Resources Division and academic community. Hypothesis testing in support of an Adaptive Management process of program improvement			
Adaptive Management	Past activity focused on data collection from vegetation monitoring without ecological targets	Application strategies are revised and refined, using the results of monitoring and new research, to improve methods for achieving target conditions and expand monitoring objectives. Lessons learned are documented in post-burn evaluation and factored into future prescribed burn plans.		

Current Assumptions: Time for wildland/urban interface protection − Calculated from wildland/urban interface funding proposals prepared in November 2000, divided by years.
Prescribed Fire - Acres for the action alternatives are based on Fire Return Interval Departure analyses, using mean and maximum intervals.
Managed Wildland Fire − Based on a minimum of 16,000 acres per year normally burned in the park under purely natural conditions.
* Forest Management Burning Handbook, California EPA, 1994, p. 7

Summary of Environmental Consequences

Table II-14
Summary of Environmental Consequences: Overall Impacts by Topic

IMPACT TOPIC	ALTERNATIVE A – NO ACTION	ALTERNATIVE B – AGGRESSIVE ACTION	ALTERNATIVE C – PASSIVE ACTION	ALTERNATIVE D – MULTIPLE ACTION (Preferred)
BIOLOGICAL ENVIRONMENT				
Vegetation	Adverse, long-term and minor to moderate impacts. High potential for high-intensity, catastrophic fires with adverse, major impacts, in lower and upper montane forests in the Suppression Unit. Type conversion of vegetation outside of the natural range of variability could occur some vegetation types.	Beneficial, long-term and moderate to major impacts, due the area treated by prescribed fire and biomass removal, especially in upper and lower montane forests, and from maximizing wildland fire use. Aggressive reduction techniques would accomplish wildland/urban interface restoration within natural range of fire return intervals in all but	Beneficial, long-term and minor to major impacts. This is based upon on an increase in the area treated by prescribed fire and the increase in wildland fire use, compared to Alternative A, but with a potential for catastrophic fire during much of the restoration period. Use of passive reduction techniques would limit site impacts but reduce the amount of treatment	Beneficial, long-term, and moderate to major; similar to Alternative B. A combination of aggressive and passive reduction techniques would limit site impacts in sensitive resource areas but accomplish wildland/urban interface restoration within the natural range of fire return intervals in all but two vegetation types.

IMPACT TOPIC	ALTERNATIVE A – NO ACTION	ALTERNATIVE B – AGGRESSIVE ACTION	ALTERNATIVE C – PASSIVE ACTION	ALTERNATIVE D – MULTIPLE ACTION (Preferred)
		two vegetation types. Reduced threat of large, catastrophic wildland fire in all areas of the park. Reduced potential for type conversion of vegetation.	in wildland/urban interface area compared to other action alternatives. The time frame for restoration is within the natural range of fire return intervals for all but five vegetation types.	
Wetlands	Adverse, short-term, and minor to moderate impacts. Potential for catastrophic wildfire, and possible fragmentation and the imposition of unnatural barriers to plant and wildlife movements.	Beneficial, long-term, and moderate impact to wetlands because of aggressive treatment to reduce threat of catastrophic fire; short-term, adverse impacts on wetland resources from activities, unless mitigated.	Beneficial, long-term, and minor to moderate impacts, due to reduced potential for catastrophic wildland fire.	Beneficial, long-term, and moderate impact to wetlands. Similar to Alternative B; but moderate to major ecological benefits for park wetlands due to multiple action approach.
Wildlife	Adverse, long-term, and major impacts, due to direct effects of high-fuel loads on habitat structure and quality in some areas, and the continued threat of catastrophic fire which has the potential to: cause wide-scale, long-term changes in park habitats; change wildlife abundance and diversity in affected areas; and require high impact suppression actions.	Beneficial, long-term, and major impacts on wildlife and habitat by rapidly restoring a more natural forest structure that would support a more natural abundance, diversity, and distribution of species. The threat of catastrophic fire and its impacts on wildlife and habitat would be greatly and quickly reduced.	Beneficial, long-term, and moderate impacts on wildlife and habitat by restoring forest structure to a more natural, fire-influenced condition that would support a more natural abundance, diversity, and distribution of species. The threat of catastrophic fire would be reduced, although the 25 years to achieve restoration would lead to unwanted wildfires.	Beneficial, long-term, and major impacts on wildlife and habitat by rapidly restoring a more natural forest structure that would support a more natural abundance, diversity, and distribution of species. The threat of catastrophic fire and its impacts on wildlife and habitat would be greatly reduced.
Species of Special Concern – Plants	Adverse, long-term, and minor impacts but catastrophic fire would cause large areas of potentially adverse, long-term, and minor to moderate impacts due to the likelihood of extreme sun exposure on site (due to loss of overstory cover and shade), and the probability of encroachment into these sites by non-native species.	Adverse, long-term, and minor impacts due to the potential increased impacts to species from mechanical treatments. Mechanical thinning and removal of fuels around developed areas, and increased burning will have an overall minimal effect on these species, due to their relative isolation, sparsely vegetated habitats, and occurrence beyond areas that would be managed aggressively.	Adverse, long-term, and negligible to minor impacts due to potential for increased manual thinning and removal as compared to Alternative A (but less than other alternatives), increased management of fuels around developed areas and increased burning would have an overall minimal effect on these species due to their relative isolation, sparsely vegetated habitats, and occurrence beyond areas that would be managed aggressively.	Adverse, long-term, and minor impacts, same as Alternative B.
Species of Special Concern – Animals				

IMPACT TOPIC	ALTERNATIVE A – NO ACTION	ALTERNATIVE B – AGGRESSIVE ACTION	ALTERNATIVE C – PASSIVE ACTION	ALTERNATIVE D – MULTIPLE ACTION (Preferred)
Sierra Nevada bighorn sheep	Beneficial, long-term, and negligible impacts.	Same as Alternative A	Same as Alternative A	Same as Alternative A
Valley elderberry longhorn beetle	Adverse, long-term, and minor impacts from potential catastrophic fire in El Portal.	Beneficial, long-term, and minor impacts due to reduction in potential for catastrophic fire.	Same as Alternative B	Same as Alternative B
California red-legged frog	Adverse, long-term, and minor impacts, due to no known populations in Yosemite	Beneficial, long-term, and minor impacts due to improvement in suitable habitat.	Same as Alternative B	Same as Alternative B
Bald Eagle	Adverse, long-term, and moderate potential impacts due to potential reduction in snags and large trees.	Beneficial, long-term, and moderate impacts due to reduced potential for catastrophic fire.	Beneficial, long-term, and minor impacts due to reduced potential for catastrophic fire.	Same as Alternative B
Mountain yellow-legged frog	Beneficial, long-term, and negligible impacts due to restoration of habitat.	Beneficial, long-term, and minor impacts due to restoration of habitat.	Same as Alternative B	Same as Alternative B
Yosemite toad	Beneficial, long-term, and negligible impacts due to potential for restored fire regime near habitat.	Beneficial, long-term, and minor impacts due to restoration of fire regime near habitat.	Same as Alternative B	Same as Alternative B
California spotted owl	Adverse, long-term, and major impacts due to potential for catastrophic fire.	Beneficial, long-term, and major impact from restoration of forest structure and reduced risk of catastrophic fire.	Beneficial, long-term, and moderate impacts from restoration of forest structure and reduced risk of catastrophic fire.	Same as Alternative B
Pacific Fisher	Adverse, long-term, and major impacts due to threat of catastrophic fire.	Beneficial, long-term, and major due to restored forest structure.	Beneficial, long-term, and moderate due to some restored forest structure.	Beneficial, long-term, and moderate to major due to restored forest structure.
Great gray owl	Adverse, long-term, and moderate impacts due to potential loss of habitat from catastrophic fire.	Beneficial, long-term, and moderate impacts due to reduced risk of catastrophic fire in owl habitat.	Same as Alternative A	Same as Alternative B
Willow flycatcher	Adverse, long-term, and minor impacts due to potential intrusion of catastrophic fire into habitat.	Beneficial, long-term, and moderate impacts due to restored conditions near riparian habitat.	Same as Alternative B	Same as Alternative B
PHYSICAL ENVIRONMENT				
Watersheds, Soils, and Water Quality	Adverse, long-term and moderate impacts based on a combination of beneficial, long-term, moderate to major impacts in the Fire Use and Conditional Units, and the	Beneficial, long-term, and major impacts, based on a combination of beneficial, long-term, moderate to major impacts in Fire Use Unit and the potential for areas of beneficial,	Beneficial, long-term and moderate impacts, based on a combination of beneficial, long-term, moderate to major impacts in Fire Use Unit and the potential for areas of beneficial,	Similar to Alternative B, beneficial, long-term, and major effects.

IMPACT TOPIC	ALTERNATIVE A – NO ACTION	ALTERNATIVE B – AGGRESSIVE ACTION	ALTERNATIVE C – PASSIVE ACTION	ALTERNATIVE D – MULTIPLE ACTION (Preferred)
	potential for adverse, long-term, and major impacts because of catastrophic fire in the Suppression Unit. Fires would potentially affect ridge, mid-slope and bottom slope areas of watersheds, increasing water yield, peak flows, nutrient yield sediment yield and stream system response.	long-term, and major impacts in Suppression Units, compared to No Action. Fires would likely affect only a portion of a slope rather than the entire vertical gradient. Reduced impacts on water yield, peak flows, nutrient yield, sediment yield, and stream system response.	long-term, and moderate impacts in the Suppression Unit. Large, high-severity fires would likely occur during the life of the plan, but the treatments proposed would reduce their effects upon soils and watersheds, including the potential for adverse effects upon water yield, peak flow, nutrient yield, sediment yield, and stream system response.	
Air Quality	Adverse, short-term, and major impacts on air quality because of continuing risk of unwanted catastrophic fires consuming areas of high fuel loadings. Impacts from prescribed fire activity would be less.	Adverse, short-term, and major impacts; largest quantity of emissions among alternatives. Intensity of impact of would be well above 50% greater than Alternative A because of prescribed fire activity.	Adverse, short-term, and major impacts; increases would be slightly above 50% of Alternative A for all emissions except volatile organic compounds (VOC). The impact on VOC emissions would be moderate.	Adverse, short-term, and major impacts since the increases in air emissions would be well above 50% of Alternative A.
CULTURAL ENVIRONMENT				
Archaeology	Adverse, long-term, and major impacts to archaeological resources mainly due to the likelihood of catastrophic fire and high-impact suppression actions. Managed wildland and prescribed fire could result in direct and indirect adverse impacts to archaeological resources, depending on the intensity of burning, the related soil and below-soil temperature, and the post-burn landscape condition, but planning and site-specific mitigations can be applied for known resources.	Beneficial, long-term, and moderate impacts, due to the reduced potential for catastrophic fire impacts; greatest reduction in the potential for these impacts on archaeological material. Potential adverse, long-term, moderate impacts from high-intensity burning during prescribed and managed wildland fires. Greatest potential for adverse impacts due to use of heavy equipment to reduce fuels. Planning and site-specific mitigations to reduce impacts.	Beneficial, long-term, and minor to moderate impacts. Similar to Alternative B, but with greater potential for catastrophic fire impacts. Potential adverse, long-term, and moderate impacts from high-intensity burning during prescribed and managed wildland fires. Planning and site-specific mitigations to reduce impacts.	Beneficial, long-term, and moderate impacts, similar to Alternative B, but with slightly greater potential for catastrophic fire and its effects on archaeological material. Potential adverse, long-term, and moderate impacts from high-intensity burning during prescribed and managed wildland fires. Planning and site-specific mitigations to reduce impacts.
Ethnographic Resources	Adverse, short-term, and minor to moderate impacts to ethnographic resources mainly due to the threat of catastrophic	Beneficial, long-term, and moderate impacts due to reductions in the potential for catastrophic fire and its impacts.	Beneficial, long-term, and minor to moderate impacts due to some decrease in the potential for catastrophic fire effects.	Beneficial, long-term, and moderate impacts. Similar to Alternative B, but with greater potential for catastrophic fire

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	fire. Managed wildland fire and prescribed fire could also result in indirect adverse impacts to ethnographic resources, depending upon the timing and intensity of fire.	Potential adverse impacts to ethnographic resources due to the increased potential for high-intensity prescribed fire and the use of heavy equipment to reduce fuel loads. Impacts would be mitigated.		effects but less potential for heavy machinery impacts. Impacts would be mitigated.
Cultural Landscape Resources	Adverse, long-term, and moderate to major mainly due to the increased threat of catastrophic fire. Of all fire management situations and treatments, catastrophic fire and emergency response actions result in the most frequent and severe impacts to cultural landscape resources. Impacts would be mitigated through planning and site-specific mitigations.	Beneficial, long-term, and moderate impacts. Greatest reduction in the potential for high intensity catastrophic fire, and the effects of suppressing it. Possible impacts from high intensity prescribed fire and use of equipment for fuel treatments. Impacts would be mitigated to the extent possible through planning and site-specific mitigations.	Beneficial, long-term, and minor impacts. Potential for catastrophic fire reduced somewhat compared to Alternative A. Impacts would be mitigated to the extent possible through planning and site-specific mitigations.	Beneficial, long-term, and moderate; similar to Alternative B. Adverse impacts would be mitigated through planning and site-specific mitigations.
SOCIAL ENVIRONMENT				
Recreation	Adverse, short-term, and minor impacts from short-term closures and restrictions because of fire management activities. During large, catastrophic fire events, closures and other needed actions would result in adverse, short-term, and major impacts.	Adverse, short-term, and minor impacts from short-term closures and restrictions because of fire management activities. The potential for large, catastrophic fires would decrease, reducing with it the potential for closures. Impacts of catastrophic fire on recreation would likely be adverse, short-term, and moderate.	Adverse, short-term, and minor impacts from short-term closures and restrictions because of fire management activities. The potential for large, catastrophic fires and the likely effect upon recreation would be similar to but less than under Alternative A.	Same as in Alternative B
Scenic Resources	Beneficial, long-term, and minor impacts from fire management actions that would maintain open vistas and natural forest structure conditions. Adverse, long-term, and major impacts from catastrophic, stand-replacement fires.	Beneficial, long-term and major impacts if fire is used as a tool to restore and maintain open vistas. Under this alternative, there would be less likelihood of large, stand-replacement fires.	Beneficial, long-term and moderate impacts due to fuel reduction and prescribed fire in the Suppression Unit. However, the potential for large, stand-replacement fires would be only slightly less than under Alternative A.	Beneficial, long-term and major impacts; similar to Alternative B.
Noise	Adverse, short-term, and moderate to major impacts, especially in wildland/urban	Short-term, adverse, and major, especially near wildland/urban interface areas. Fuel reduction	Short-term, adverse, and major impacts, especially near wildland/urban interface areas.	Adverse, short-term, and major impacts; similar to Alternative B.

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	interface areas and particularly during large, catastrophic fire events. In Wilderness, helicopter and chainsaw noises would continue to introduce short-term intrusions, with adverse and major impacts.	activity and the duration of fuel treatment operations would be substantially greater than under Alternative A. In Wilderness, effects would be the same as in Alternative A.	The noise events would be similar but more than that found in Alternative A. During catastrophic fire events and in Wilderness, effects would be the same as in Alternative A.	
Local Communities	Beneficial, long-term, and minor impacts. Small reduction in risk of wildland fire in local communities; due to limited amount of prescribed fire and fuel treatment. Potential for catastrophic fire would remain high; the risk for direct effects (loss of property during fires) and indirect effects (loss of business during fire-related closures) would be highest among the alternatives.	Beneficial, long-term, and moderate to major impacts because prescribed fire and mechanical thinning would restore plant community conditions near communities, reducing the risk of catastrophic loss. Risks associated with large, catastrophic fires would be greatly reduced in this alternative; direct effects (loss of property during fires) and indirect effects (loss of business during fire-related closures) least among alternatives.	Beneficial, long-term and moderate impacts due to long-term reduction in risk of catastrophic fires; direct effects (loss of property during fires) and indirect effects (loss of business during fire-related closures) would be reduced, but would remain the highest among the action alternatives. This is because of a smaller amount of annual prescribed fire and mechanical thinning to restore plant communities in the Suppression Unit.	Beneficial, long-term, and moderate to major impacts; similar to Alternative B.
Environmental Justice	Beneficial, long-term, and minor impacts upon minority and low income populations in park communities due to risk reduction work, which would be focused upon the most immediate risks associated with wildland/urban interface areas	Beneficial, long-term, and moderate to major impacts upon minority and low-income populations in park communities due to risk reduction work. Prescribed fire and fuel treatment would continue to be focused upon the immediate risks associated with wildland/urban interface areas.	Beneficial, long-term, and moderate impacts upon minority and low income populations in park communities. Prescribed fire and fuel treatment would continue to be focused upon the immediate risks associated with wildland/urban interface areas.	Beneficial, long-term and moderate to major impacts, similar to Alternative B.
SPECIAL DESIGNATIONS				
Wilderness	Beneficial, long-term, and minor to moderate impacts due to allowing natural processes, thus maintaining Wilderness values, especially in the Fire Use and Conditional Units. Effects in the Suppression Unit limited by amount of prescribed burning and high risk of catastrophic	Beneficial, long-term and moderate to major impacts due to actions that would maintain plant communities within their natural range of variability, and thus maintain Wilderness values, especially in the Fire Use Unit. Reduced potential for catastrophic fires that could	Beneficial, long-term and minor to moderate impacts. Similar to Alternative A, but greater amount of fuels treatment and prescribed fire. However, the potential for catastrophic fires that could spread into Wilderness would remain high during most of the planning	Beneficial, long-term, and moderate to major effects; similar to Alternative B.

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	fires. In Wilderness, helicopter and chainsaw noises would continue to introduce short-term intrusions with adverse and major impacts.	spread into Wilderness. In Wilderness, helicopter and chainsaw noises would continue to introduce short-term intrusions which would have adverse and major impacts.	period.	
ENERGY				
Energy Consumption	Adverse, long-term, and negligible. Estimate of 9,683 gallons of various fuels used in fire management activities in an average year.	Adverse, long-term, and major, with approx. 250,339 gallons of various fuels used in fire management activities in an average year.	Adverse, long-term, and minor, with approx. 22,368 gallons of various fuels used in fire management activities, in an average year.	Adverse, long-term, and major, with approx. 147,462 gallons of various fuels used in fire management activities in an average year.
DETERMINATION OF POTENTIAL IMPROVEMENT OF PARK RESOURCES				
Potential for Impairment of Park Values	Increasing potential for catastrophic fire in or near giant sequoia groves, historic districts, and highly scenic areas. Loss of these natural and cultural resources would likely constitute impairment.	This alternative represents the most aggressive effort to reduce the potential for catastrophic fire and to restore and maintain forest structure and other natural and cultural resource values. No impairment.	The least aggressive of the action alternatives; would reduce the potential for catastrophic fire compared to Alternative A. Actions would restore and maintain forest structure and other natural and cultural resource values. No Impairment.	Similar to Alternative B but slightly less aggressive effort to quickly reduce the potential for catastrophic fire and restore and maintain forest structure and other natural and cultural resource values. No Impairment.
POTENTIAL CONFLICTS BETWEEN EACH ALTERNATIVE AND OTHER LAWS AND POLICIES				
Potential conflict with Section 101, NEPA or other laws	Conflicts with Section 101, NEPA and results in continued environmental degradation. Increased risk of catastrophic fire; values at risk include communities, historic districts, and other cultural resources; limited amount of accomplishment addresses neither requirements for restoring resources or protecting communities; fails to enhance quality of renewable resources.	Resolves conflicts of Alternative A: Most aggressively reverses environmental degradation, with a high dependence upon aggressive means; reduces risk for high intensity, catastrophic fire. Addresses the need to restore natural resources and protect communities and cultural resources. Addresses need to enhance renewable resources. No identified conflicts with other laws.	Resolves the conflicts of Alternative A: Limited amount of accomplishment toward reducing risk of catastrophic fire, restoration of natural resources and protection of communities and cultural resources. Limited actions to addresses need to enhance renewable resources. No identified conflicts with other laws.	Resolves conflicts of Alternative A: Reverses environmental degradation with a balanced approach to use of both aggressive and passive/low profile techniques; reduces risk of catastrophic fire. Addresses need to restore natural resources and protect communities and cultural resources. Addresses need to enhance renewable resources. No identified conflicts with other laws.

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Consistency with Federal Fire Policy	Is inconsistent with the Federal Fire Policy.	Is consistent with the Federal Fire Policy.	Is consistent with Federal Fire Policy.	Is consistent with Federal Fire Policy.